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COLEOPTERA.

GENERAL INTRODUCTION
AND
CICINDELIDÆ AND PAUSSIDÆ.

BY

W. W. FOWLER, M.A., D.Sc., F.L.S.

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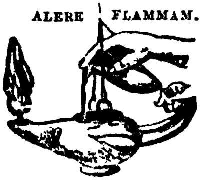
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AUTHOR'S PREFACE.

THIS Volume was begun some years ago, but partly through want of leisure and partly through the necessity of rewriting considerable portions of the work in order to bring it up to date, its issue has been delayed.

There was no intention at first of drawing up a general introduction to the Coleoptera, but it was thought advisable by Colonel Bingham, the late editor of the series, that this should be done, and it is therefore added. The more, however, the question is studied, the more impossible it appears to lay down hard and fast rules with regard to phylogeny, classification, or in fact any general point connected with the Order; what is accepted one year is rejected the next. Any introduction must therefore be regarded as provisional and as merely a help towards further knowledge.

I must express my thanks to my old friend Dr. David Sharp, whose system I have in the main followed, and who has always been most ready to assist me with advice or criticism, and also to Dr. W. Horn (who on several occasions has sent me unique specimens for examination) for the great help he has given me with the CICINDELIDÆ, and to Herr Ludwig Ganglbauer not only for the permission to make use of several of the illustrations in his excellent work 'Die Käfer von Mitteleuropa,' but for the exceedingly kind letter in which he gave that permission. I am also greatly indebted to Mr. C. O. Waterhouse, Mr. C. J. Gahan, and Mr. Gilbert J. Arrow for much assistance at the British Museum, to Professor E. B. Poulton for the loan of insects from the Oxford Museum (Hope Department), to Mr. H. E. Andrewes, Mr. H. Leslie Andrewes and the late Mr. B. G. Nevinson for sending me many valuable species for inspection and figuring, and to Mr. N. Annandale for the loan of CICINDELIDÆ from the Calcutta Museum. I must also thank Herr Wassmann for help with regard to several of the PAUSSIDÆ, M. A. Lameere for kindly sending me a copy of his Classification, and Mr. Guy A. K. Marshall, Mr. G. C. Champion, Mr. C. W. Woodworth, and others for assistance on various points. I would further express my obligations to the Council of the Entomological Society of London for allowing me to make use of two illustrations from their Transactions.

The illustrations of the different species of beetles are in nearly all cases original; the structural and larval figures are from various sources, all of which are acknowledged in the text. The perfect insects figured in the Introduction are almost without exception found in the Indian Region; in one way this is, of course, an advantage, but in another the observance of the rule has in some cases prevented really typical species of the families from being represented.

W. W. FOWLER.

January 1st, 1912.

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ORDER COLEOPTERA.

THE Coleoptera or Beetles are chiefly characterized by having the anterior pair of wings, commonly called the elytra, more or less horny or leathery (more often the former) and, as a rule, but by no means always, fitting closely down the back with a straight suture. These elytra are not adapted for flying, although they evidently help to support the insect in the air, but serve as sheaths for the posterior pair of wings (commonly spoken of as the wings) which are usually large and ample, and in flight extend far beyond the elytra, beneath which they are more or less elaborately folded when at rest. In many cases the wings are much reduced, and are often quite rudimentary; very few beetles, however, are absolutely wingless, except such forms as the females of *Drilus*, *Lampyris*, and *Pachypus*, which are destitute of both wings and elytra. In cases where the wings are aborted and rudimentary (as in *Carabus*, etc.), the elytra are often fused together at the suture, and the whole of the upper surface of the hinder portion of the body is practically covered with a solid mass of chitinous material. Darwin's remarks on the species with aborted wings are well known to most of us, but may be quoted again with advantage. In speaking of the beetles of Madeira he says:—" Mr. Wollaston has discovered the remarkable fact that 200 beetles, out of the 550 species (but more are now known) inhabiting Madeira, are so far deficient in wings that they cannot fly; and that, of the twenty-nine endemic genera, no less than twenty-three have all their species in this condition! Several facts, namely, that beetles in many parts of the world are frequently blown to sea and perish; that the beetles in Madeira, as observed by Mr. Wollaston, lie much concealed, until the wind lulls and the sun shines; that the proportion of wingless beetles is larger on the exposed Desertas than in Madeira itself; and especially the extraordinary fact, so strongly insisted on by Mr. Wollaston, that certain large groups of beetles, elsewhere excessively numerous, which absolutely require the use of their wings, are here almost entirely absent*, these several considerations make me believe that the wingless condition of so many Madeira beetles is mainly due to the action of natural selection, combined probably with disuse. For during many successive generations each individual beetle which flew least, either from its wings having been ever so little less perfectly developed, or from indolent habit, will have had the best chance of surviving from not being blown out to sea; and, on the other hand, those beetles which most readily took to flight would oftenest have been blown to sea, and thus destroyed."*

---

* Darwin does not allude to one of the most striking facts recorded by Wollaston, viz.:—that numerous genera (*Loricera*, *Trechus*, *Hydrobius*, etc.) which are usually winged, are almost entirely apterous in Madeira; nor to the inexplicable exception of *Pristonychus*, which has ample wings, although in other countries they are usually obsolete. (Wollaston, Insects of the Madeira Islands, p. xii).

Whether Darwin's inferences are correct may be doubted, for large and powerful forms with rudimentary wings occur far from the sea, but the facts with regard to Madeira are certainly striking.

In some forms of Coleoptera the elytra are not evenly joined at the suture, and in some (e.g. *Sitaris*, *Meloë*, etc.) there is no suture at all, the elytra being quite separated or to a greater or lesser extent overlapping.

The venation of the elytra is, as a rule, not evident, as might be expected from the material of which they are composed, but the venation of the wings is very distinct and varies very considerably. Until quite recently very little use has been made of this character in the Coleoptera, although the importance of the neuration of the wings has long been recognized in the Lepidoptera and, to a less extent, in the Diptera; much more attention is now being paid to it as an aid to classification, and it will be referred to at greater length further on.

External Structure.

The principal parts of the body are the *head*, *thorax*, and *abdomen*. The head is free and very mobile, usually short and normal, but occasionally more or less produced, and in most of the RHYNCHOPHORA provided with a *rostrum* or beak-like process: this rostrum is in no sense a trunk, but an integral part of the head, and the mouth organs are situated not at its base, as might be supposed, but at its apex: the front of the head is often called the *vertex* and the hinder part the *occiput*, but as the occiput proper is not found in the Coleoptera, the upper surface of the head as visible is commonly spoken of as the vertex: in front of the vertex and usually separated from it by a distinct suture lies the *clypeus* or *epistoma*.

The mouth organs proper consist of a *labrum* or upper lip, which adjoins the clypeus and is sometimes hidden behind it, or even connate with it; it is very variable in size, and is absent in the RHYNCHOPHORA except in the RHINOMACERIDÆ, ANTHRIBIDÆ, and PLATYPIDÆ. In some orders of insects (*e. g.* Neuroptera) the clypeus is often divided into two parts, while in others (*e. g.* Siphonaptera) both the clypeus and labrum are wanting. Beneath the labrum come the large jaws or *mandibles*; these vary according to the food of the insect. In the carnivorous beetles they are usually sharp-pointed and furnished with a cutting edge in order to seize, hold and cut up their living and struggling prey; in the plant and dung feeding beetles they are short, broad and blunt, and adapted, as we might expect, for trituration rather than for holding and cutting. These mandibles nearly always move horizontally; a single exception occurs, however, in the Rhynchophorous genus *Balaninus* in which they move vertically. Below the mandibles there is a second pair of horizontally moving jaws called the *maxillæ*; as a rule, they are made up of the following portions:—(1) the *cardo* or hinge, the piece by which the whole maxilla articulates with the head; (2) the *stipes* or stalk, following and articulating with the cardo; (3) the supporting piece of the palpus, called the *palpifer* or *squama palpigera* *; (4) the *lacinia* or blade, with a cutting or triturating edge, which is regarded as the inner lobe of the maxilla; (5) the external or outer lobe or *galea*, which may be jointed, entire, rudimentary, or even absent; (6) the *maxillary palpus*, which is usually shaped like an antenna, and is generally 4-jointed, sometimes 3-jointed, and very rarely (as in *Aleochara*) 5-jointed. In the PSELAPHIDÆ and HYDROPHILIDÆ

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* Origin of Species, 6th Ed. p. 100.

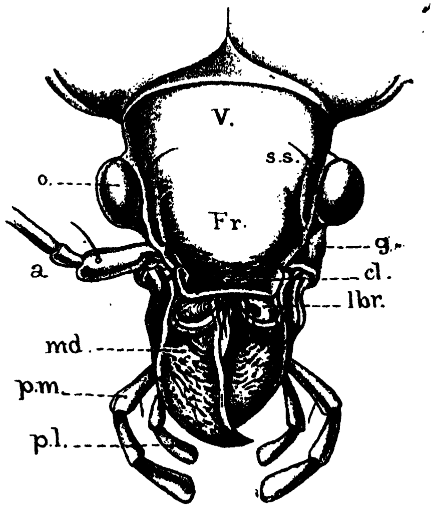

Fig. 1.—Head of *Calosoma sycophanta*. *V.*, vertex; *Fr.*, frons; *s.s.*, supra-orbital seta; *o.*, eye; *g.*, gena or cheek; *a.*, antenna; *cl.*, clypeus; *lbr.*, labrum; *md.*, mandible; *p.m.*, maxillary palpus; *p.l.*, labial palpus. (After Ganglbauer.)

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* As a matter of fact the palpifer appears to consist of two pieces, one supporting the maxillary palpus, and the other the galea; the inner of these pieces is therefore sometimes called the *sub-galea*.

this organ is very much developed; indeed the latter family has been styled from this fact **Palpicornia** by some authors. Underneath the maxillæ and forming the floor of the mouth is found the *mentum*, which, together with the *ligula* (a variable process situated in front of the mentum), makes up the *labium* or lower lip; the term *ligula*, however, is sometimes loosely applied to the front portion only of the ligula proper, which is in some genera considerably extended, and apparently, but not really, distinct. From supports situated at the base of the ligula arise the *labial palpi*, which in general style, as a rule, resemble the maxillary palpi; these are usually 3-jointed, sometimes 2-jointed and rarely setiform. On each side of the front of the labium is often found a more or less developed membranous appendage, known as the *paraglossa*: these are sometimes connate, or almost connate, with the labium, but often extend, as curved points or blunt projections, considerably beyond its apex.

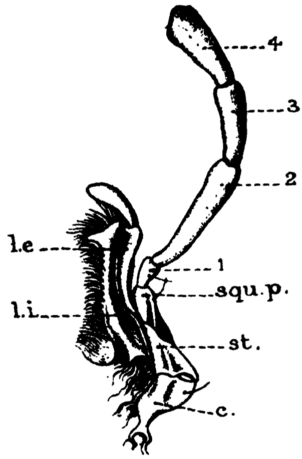

Fig. 2.—Maxilla of *Calosoma sycophanta*. *c.*, cardo; *st.*, stipes; *squ.p.*, squama palpigera; *l.i*, internal lobe of maxilla; *l.e.*, external lobe of maxilla, two-jointed; 1, 2, 3, 4, joints of maxillary palpus. (After Ganglbauer.)

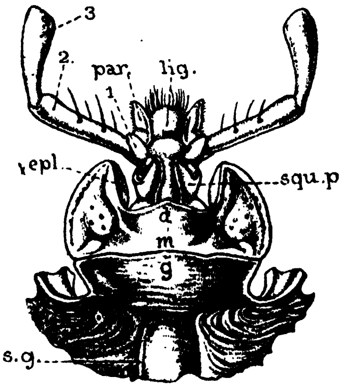

Fig. 3.—Labium of *Calosoma sycophanta*. *m.*, mentum; *d.*, tooth of mentum; *epl.*, epilobe of mentum; *squ.p.*, squama palpigera; 1, 2, 3, joints of labial palpi; *lig.*, ligula; *par.*, paraglossa; *g.*, gula; *s.g.*, gular sutures. (After Ganglbauer.)

The *eyes* are very variable in size and shape; they may be round, oblong, kidney-shaped, deeply emarginate or entirely divided, as in *Gyrinus*. In this latter genus and its allies the beetle is provided with four distinct eyes, two on the upper surface of the head and two on the under surface, so that it is admirably adapted for its usual position on the surface of the water. The number of facets in the eyes is also very variable, though not so much so, perhaps, as in the Hymenoptera. In some cases, e. g. *Homalium* (STAPHYLINIDÆ), ocelli, or small complementary eyes, consisting of single lenses, are present. The existence of these ocelli is usually considered to indicate that the form is primitive and to show that it bears a close relation to its remote ancestor, the purely hypothetical and probably mythical *Protocoleopteron*.

The *antennæ* are appendages of very varied length and shape, which are inserted in front of, or, more rarely, between the eyes; in the RHYNCHOPHORA they arise from the rostrum either further from, or nearer to, the base; very rarely they consist of a single joint (*Articerus*); in a considerable number of the PAUSSIDÆ and in *Adranus* they are 2-jointed, but in the great majority of the Coleoptera they are 11-jointed. The different forms of the antennæ have been largely used in classification, but although valuable in this respect, they are not in all groups (*e. g.* the CLAVICORNIA) to be entirely relied upon; roughly speaking they may be classed under four heads:—

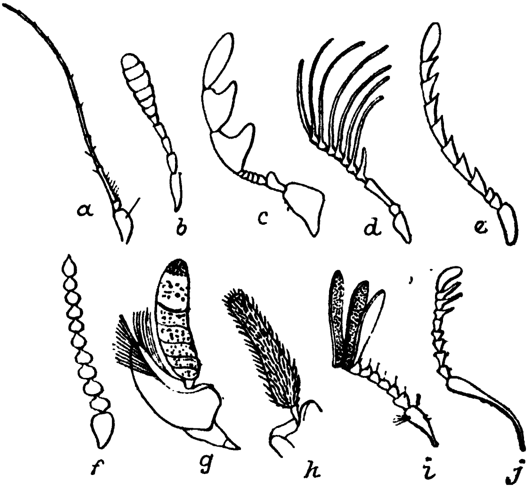

Fig. 4.—Forms of antennæ. *a*, filiform (*Cicindela*); *b*, clavate (*Colon*); *c*, irregularly serrate (*Dorcatoma*); *d*, flabellate (*Acneus*); *e*, serrate (*Ludius*); *f*, moniliform (*Rhysodes*); *g*, irregular (*Dineutes*); *h*, abnormally clavate (*Adranus*); *i*, lamellate (*Lachnosterna*); *j*, lamellate (*Lucanus*). (Mostly after Leconte and Horn.)

1. *Filiform*: where the joints are more or less elongate and not, or scarcely, enlarged towards the apex; if they taper they are called *setaceous*. If the joints do not differ much in size and are more or less rounded, like beads on a necklace, the antennæ are called *moniliform*.

2. *Clavate*: in this group the outer joints form a more or less distinct club; if it is abrupt the antennæ are said to be *capitate*.

3. *Serrate*: in these the joints are, in the typical form, triangular, like the teeth of a saw, but as a matter of fact the group is extremely variable. In many cases the last three joints only are irregularly serrate and are considerably enlarged, forming a more or less strong club, and therefore perhaps belonging rather to the second group; in others the joints are largely extended laterally and the antennæ are then called *pectinate*, and if extended on both sides *bipectinate* (in certain Australian moths we even find tripectinate antennæ); in cases of further extension they are styled *flabellate*, or (when feathery) *plumose*.

4. *Lamellate*: this is really a form of the clavate antenna, in which the clava or club takes the shape of plates which oppose flat surfaces to one another. The apposition may be loose (as in the MELOLONTHIDÆ) or strong (as in the GEOTRUPIDÆ); in the latter case the antennæ appear to be capitate at first sight rather than lamellate. The small club of *Lucanus* is termed *fissate*.

The above types are all that need be particularly noticed. Certain others occur but they are really modifications of one or the other of the four above-mentioned; in fact we may perhaps say that all the forms are gradual modifications of the filiform type. When the first joint is much prolonged the antennæ are called *geniculate*. This is usual in the Rhynchophorous series, in which the first joint is styled the *scape* and the joints between the scape and the club are called the *funiculus*. We find, however, geniculate forms in other families also.

The functions of the antennæ are mainly sensorial. Graber states that he has observed Longicorns using them as a sort of balancing pole when walking along a twig or small branch, but this adjustment of balance would apply to all parts of the body in all orders, and could not be described as a function of the antennæ.

The *head* as a whole is firmly supported by the broad prothorax, into which it is more or less sunk, or it is attached to a more or less distinct neck. At the hinder part of the head there is the opening (occipital foramen) into the trunk; through the occipital foramen the organs of the head are connected with those of the trunk. This is very distinct in *Hydroüs* and indeed in most Coleoptera. The cheek (gena) is at the side of the head and to its inner wall is attached the mandibular muscle. The walls of the head are supported or braced within by the *tentorium*, which consists of a central plate from which diverge two pairs of arms extending to the skull: it braces the skull, affords muscular attachments and holds in place the cephalic ganglia and the œsophagus (Folsom): in Coleoptera (*Hydroüs*, etc.), it protects the nervous cord which passes under it.

The *thorax* is made up of three parts, the *prothorax*, *mesothorax*, and *metathorax*; these are often spoken of, for convenience' sake, as the *pronotum*, *mesonotum*, and *metanotum*, but these terms should properly be applied to the upper parts only, the lower portions being rightly called respectively the *prosternum*, *mesosternum*, and *metasternum*. The prothorax is quite free and never soldered to the mesothorax: this is one of the leading characteristics of the order. The pronotum is visible entirely from above, while the metanotum is entirely covered by the elytra; a small portion of the mesonotum is usually visible and this is known as the *scutellum*. The prosternum, mesosternum, and metasternum bear respectively the anterior, intermediate, and posterior pairs of legs,

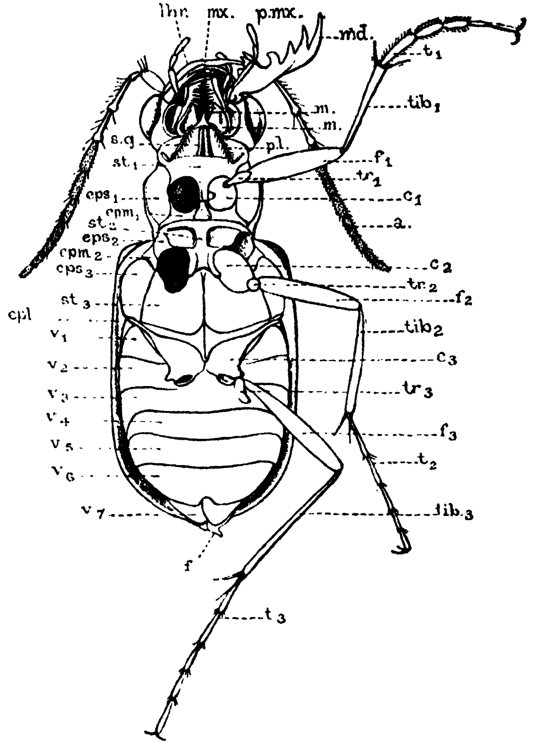

Fig. 5.—Underside of *Cicindela campestris*, male. *a*, antenna; *lbr.*, anterior margin of labrum; *md.*, mandible; *mx.*, maxilla; *p.mx.*, maxillary palpus; *m.*, *m.*, mentum and tooth of mentum; *p.l.*, labial palpus; *s.g.*, gular sutures; st_1, prosternum; st_2, mesosternum; st_3, metasternum; eps_1, eps_2, eps_3, episterna of the prosternum, mesosternum, and metasternum; epm_1, epm_2, epimera of the prosternum and mesosternum; *epl.*, epipleura; v_1 to v_7, ventral segments of abdomen; *f*, ædeagus.

c_1, c_2, c_3, coxæ
tr_1, tr_2, tr_3, trochanters
f_1, f_2, f_3, femora
tib_1, tib_2, tib_3, tibiæ
t_1, t_2, t_3, tarsi
of the front, middle, and hind legs.
(After Ganglbauer.)

while the mesonotum carries the elytra, and the metanotum the membranous wings. Each of the sterna is made up of three parts: the central (or sternum proper), the episternum, and the epimeron. The whole of these parts are seldom visible in any one insect, some of them being often more or less hidden by the *epipleuræ* or reflexed sides of the elytra. An insect has no internal skeleton proper, but the structure of the tentorium is more or less repeated in the segments of the thorax and in all these the extensions must be regarded as really ingrowths of the external skeleton. These are of three kinds: dorsal or *phragmata*, lateral or *apodemes*, and ventral or *apophyses*; the latter term is somewhat unfortunate, as it is also applied to the appendages of the apical abdominal segments of the COLLYRINÆ, etc. The *phragmata* have evidently to do with the muscles of the wings, as there are none in the prothorax, while the *apodemes* and *apophyses* probably support the muscles of the legs.

The *legs* are six in number and are extremely variable in size and shape, according to the purposes for which they are adapted. In very active species, such as the CICINDELIDÆ, they are very long and slender (sometimes extraordinarily so), while in the case of the fossorial beetles they are, as might be expected, short, broad, and very hard; in the DYTISCIDÆ the hind pair are formed for swimming, and in the HALTICIDÆ, with their strongly thickened femora, for jumping; occasionally, as in *Sagra*, the hind femora are very strongly thickened, though the insects have no jumping power; in many of the CURCULIONIDÆ the legs are especially adapted for clinging, while in numerous cases they are strongly retractile and fit closely to the body, enabling the insect to escape, without attracting notice, as long as it keeps motionless and feigns death. The legs are joined to the body by the *coxæ*, which fit into cavities called the *coxal cavities* or *acetabula* and form a more or less perfect ball and socket joint. These cavities are formed by two sterna, or are situated entirely within the prosternum. In the first case they are said to be open behind, and, in the second, to be closed behind: this is a very important point in classification, and the species with the anterior coxal cavities closed probably belong to more perfectly developed forms. The portion of the leg next the coxa is called the *femur*, and to the base of this is sometimes joined a small and somewhat variable piece called the *trochanter*; in some genera this is almost or quite absent, in others it is strongly developed. On the outer side of the anterior and middle coxæ a small piece, not connected with the legs, is sometimes present: this is called the *trochantin* or *paracoxa*. Next to the femur comes the *tibia*, and next to the tibia the *tarsus*, which is never composed of more than five joints, and very rarely, if ever, has less than two. The number of these joints has formed the basis of several of the classifications of Coleoptera, and is still held to be of considerable weight; but it gives rise to many difficulties, and it would perhaps be best to follow Latreille's rule (Gen. Crustac. et Insect. i, p. 172), quoted by Lacordaire (Gen. Col. i, p. xiii):

"Articulorum tarsorum progressio numerica in methodo naturali non admittenda." It must, however, be admitted that Latreille did not carry out this rule in his own practice, for, as Westwood says (Classification, i, p. 301), the tarsal system of Olivier was almost universally adopted, chiefly in consequence of Latreille having employed it in his numerous works. The last joint of the tarsus is called the *onychium* and bears the double or single claws; in tree- and plant-frequenting beetles (e. g. *Collyris*, certain species of *Stenus*, and many PHYTOPHAGA) it is strongly bilobed.

The *abdomen* is divided into segments, but with regard to its composition there has been much difference of opinion, and great difficulty has been caused by the conflicting ideas regarding the number of segments which have been expressed by various authors; five or six are usually visible on the under side (these being called ventral segments), but if the elytra are removed seven, eight, or nine will be seen on the upper side. This is due, as Dr. Sharp has pointed out (Cambridge Natural History, vi, p. 186), to two facts: "1, that the hind coxæ have a great and complex development, so that they conceal the true base of the venter, which, moreover, remains membranous to a greater or less extent, and thus allows much mobility, and at the same time a very accurate co-adaptation between the hard parts of the venter and the metasternum [except in the MALACODERMIDÆ, where this coadaptation is wanting, or is imperfect]; 2, that the terminal segments are withdrawn into the interior of the body, and are correspondingly much modified, the modification being greater in the case of the ventral than in that of the dorsal plates." In spite of the work of Verhoeff (Deutsche Ent. Zeitschr. 1893–4, etc.), and others, the question of the real number of dorsal and ventral plates cannot be regarded as settled, and students should be careful to make plain to themselves the nomenclature of the segments adopted by any author whom they may be consulting: as some regard the last dorsal segment as the eighth, while others take it as the seventh, it is better in descriptions to speak of the last and penultimate joints.

Internal Structure.

Many of the older writers on insects, such as Burmeister, Dufour, Newport, etc., paid considerable attention to the internal structure and economy of insects, and, to judge by the way in which their work and figures are used by recent authors, they must have been in the main very acute observers. The best general books on these matters seem to be Packard's Text-Book of Entomology and Kolbe's 'Insektenkunde': the work of Dr. Sharp in the Cambridge Manual of Natural History, Vols. V and VI, is also useful, and there is much that is valuable in Burmeister's Manual of Entomology (1836), pp. 119–301. The writers on particular points of structure etc. are legion, as may be seen by examining the bibliography of any particular section.

The Alimentary Canal.

The organs of nutrition in insects consist of the intestinal canal and its appendages. Except very rarely in the case of certain

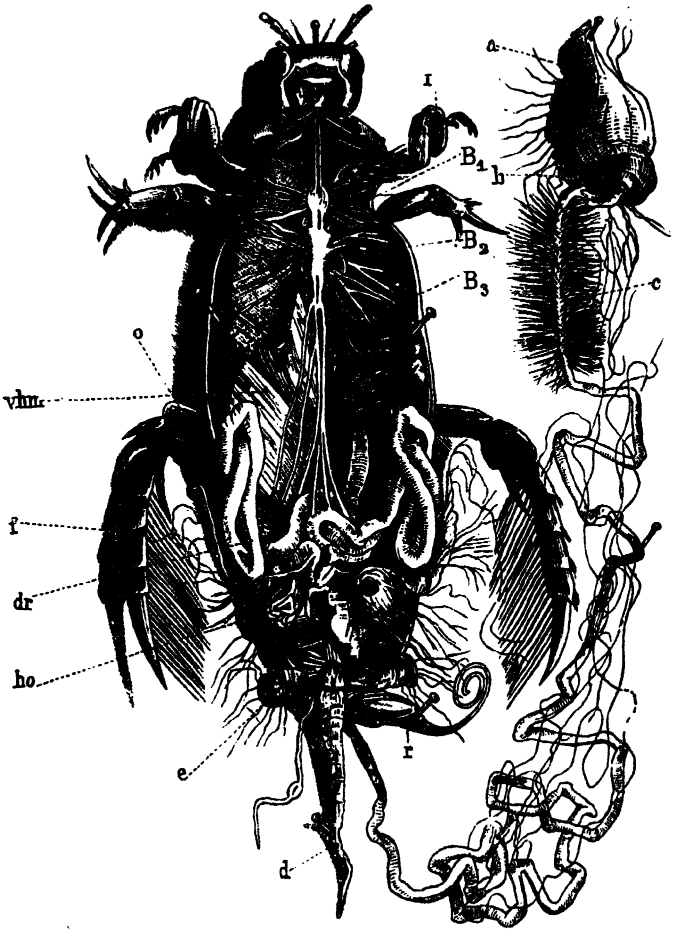

Fig. 6.—*Dytiscus marginalis*, male, opened from the back. *a*, œsophagus or crop; *b*, proventriculus or fore-stomach; *c*, ventriculus or mid-intestine, with hair-like cæcal glands, passing into the long intestine (ileum, colon, and rectum): the fine threads represent the Malpighian tubes; *d*, much developed cæcal appendage: *e*, reservoir for secretion of anal gland; *f*, hind tarsus; *i*, dilated joints of anterior tarsus; *o*, femur; *r*, ædeagus; *vhm*, extensor muscle of hind leg: *dr*, accessory gland; *ho*, testis; B_1 B_2, B_3, apodemes, or processes supporting the divisions of the thorax. It will be noticed that the ganglia (lying close to B_1 and B_2) show considerable concentration. (After Graber.)

larvæ, this canal in all insects is terminated by a mouth at one end and an anus at the other. The mouth opens upon the pharynx, which, in the Coleoptera, is merely a slightly widened commencement of the œsophagus, and need not be considered as distinct from the latter. The œsophagus is a simple tube, varying in size and length; it is largest in those insects which feed on solid, usually vegetable, food, and smallest in those living on liquid food: it merges into the crop, but the latter is not always present, being merely an enlargement, under special conditions, of the end of the œsophagus, lined internally with a muscular coat. According to Packard the crop is very large in locusts and other Orthoptera (with the exception of the PHASMIDÆ), in the Dermaptera, and most of the imagines of the Coleoptera. In the larvæ it is sometimes present and sometimes wanting; it exists in the larva of *Calandra*, for instance, but not in that of *Calosoma*; also, according to Beauregard, it is wanting in the pollen-eating beetles *Zonitis*, *Sitaris*, and *Mylabris*, while in *Meloë* it is highly developed (Kolbe).

In some orders of insects a thin pouch is present connected by a slender neck with the end of the œsophagus: this is called the "sucking stomach"; by older writers it was considered not to be a receptacle for food, but to promote the suction of food "by distending at the will of the insect, and thus, by the rarefaction of the air contained within it, facilitating the rise of fluids in the proboscis and œsophagus." Graber, however, has proved that, though generally found to contain nothing but air, it is simply a reservoir for the temporary reception of food. This he did by feeding flies with a coloured sweet fluid, and observing that the organ could "be seen filling itself fuller and fuller with the coloured fluid, the sac gradually distending until it occupied half the hind-body." *

The so-called "sucking stomach," however, does not occur in the Coleoptera. In this order the œsophagus, or the crop, if present, is followed by the proventriculus or fore-stomach, a small, narrow, tubular, or subglobose cavity, furnished within with rugose folds, teeth, spines, or horny ridges. This organ is well developed in all the carnivorous and wood-feeding beetles (notably the CARABIDÆ, DYTISCIDÆ, and SCOLYTIDÆ), and in fact, in all mandibulate insects which feed on hard and indigestible substances; it has usually been considered to correspond with the gizzard of the gallinaceous birds, and this opinion is still held by many, although some think that its function is rather that of straining than triturating, and others consider that the teeth, etc. are merely used to pass the food backward into the mid-intestine, which follows just behind the proventriculus.

The "mid-intestine," "ventriculus," "chylific ventricle," or "chylific stomach" is very differently described by different authors, owing to its variability. Sometimes, as Dr. Sharp says, it is very elongate so that it is coiled and like an intestine in shape; in the Coleoptera it often bears elongate diverticula or pouches, especially on the anterior part, these being sometimes (e. g., *Carabus*) so numerous that the whole surface seems villose. In some cases this stomach seems to be divided and the hinder part appears to be a portion of the small intestine; but the point can easily be settled by the position of the Malpighian tubes, which are always attached at the junction of the stomach and intestine. This mid-intestine varies very much in the Coleoptera. In the Lamellicornia (*Melolontha* and *Geotrupes*) it is very long; in *Meloë* exceedingly large, occupying most of the body-cavity; while in the Longicornia it is very small.

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* See Packard, A Text-Book of Entomology, p. 305.

The small intestine, or, as it is usually called by those who regard the mid-intestine as the true stomach, "the intestine," is also very variable. The anterior part, which is slender, is called sometimes the small intestine, or the ileum; in some of the Adephaga, as *Dytiscus*, and in *Necrophorus* it is very long, but it is rather slender and short in the CARABIDÆ and CICINDELIDÆ, as well as in those insects whose food is liquid, such as Diptera. In the Lepidoptera it varies in length, being in *Sphinx* quite long and bent into seven folds, while it is short in the CHRYSOMELIDÆ, and also in the PSOCIDÆ and TENTHREDINIDÆ. The part next to the ileum is called the colon, while the terminal section forms the rectum; the colon, however, is sometimes regarded as merged in the rectum. In butterflies and probably in most Lepidoptera, the colon is distinct and is anteriorly developed into a large bladder-like cæcum. In certain Coleoptera (e. g., *Dytiscus*, *Silpha*, and *Necrophorus*) this cæcum is of remarkable length and shape. The rectum, when separate, is larger than the colon, and is furnished in many insects with peculiar structures called rectal glands; these are very conspicuous in certain Orthoptera, and are found among the Coleoptera; whether they are really glands is very doubtful, from their structure and position. Fernald regards the rectal glands of *Passalus* as "acting like a valve, serving to retain the food in the absorptive portions of the digestive tract till all nutriment is extracted" (Packard).

The anus is situated at the end of the body and is present in all the Coleoptera both in the larval and perfect state. Connected with the anus are certain "eversible repugnatorial glands," called ordinarily the anal glands, of which a long and interesting account is given by Packard (Text-Book of Entomology, pp. 372–380). These glands secrete pungent and corrosive fluids which can be ejected sometimes to a considerable distance, and form a very effective means of defence; they are especially noticeable in certain Californian species of *Eleodes*, which Williston describes as the "veritable skunks of the order," and also in *Blaps*.

"Similar glands, though usually smaller, which have not been carefully examined, occur in *Carabus* and *Cychrus*, which eject from the vent a disagreeable fluid containing butyric acid. The bombardier beetle, *Brachinus*, with its anal glands, ejects a jet of bluish vapour accompanied with a considerable explosion, which colours the human skin rust-red; it is caustic, smells like nitrous acid, and turns blue paper red. Westwood states that individuals of a large South American *Brachinus*, on being seized immediately began to play off their artillery, burning and staining the flesh to such a degree that only a few specimens could be captured with the naked hand, leaving a mark which remained for a considerable time. The fluid ejected by another species, in Tripoli, blackened the fingers of the collector. It is neither alkaline nor acid, and it is soluble in water and in alcohol" (Kirby and Spence, iv, p. 149).

"Species of other genera (*Agonum*, *Pheropsophus*, *Galerita*, *Paussus*, *Ozæna*) are also bombardiers [the power is especially noticeable in *Pheropsophus*]. A Paussid beetle (*Cerapterus*) ejects explosively a fluid containing free iodine (Loman), while *Staphylinus*, *Stenus*, *Ocypus*, *Lacon*, etc., have similar anal fœtid glands, the liquid being more or less corrosive. The secretion of *Mormolyce phyllodes* is so corrosive that it is said to paralyse the fingers for 24 hours after" (Cuénot, quoted by Packard).

The larva of *Hydrophilus piceus* ejects a black fœtid fluid from the anus; the DYTISCIDÆ eject a colourless disagreeable fluid; the SILPHIDÆ have only one anal gland from which they throw out an ammoniacal liquid. There are, of course, many other secretions emitted by Coleoptera, but these do not arise from the anal glands and are best considered under the separate families.

We have already alluded to the Malpighian tubes. These are attached to the junction of the stomach and intestine, and are present in almost all insects, but vary very greatly in length, shape, and number, sometimes only two being present and sometimes a hundred or more; they derived their name from the Italian anatomist Malpighi who first discovered them. At first they were thought to be biliary tubes, but were afterwards regarded as excretory or urinary organs, answering to the kidneys of the higher animals. In the Coleoptera their number is either four or six, and this difference, which will be again alluded to, has been represented by authors as an important point in the classification of the order.

The salivary glands and the silk glands are offshoots of the œsophagus, the former being present in many insects, but absent in others, and varying very much in size. They consist "either of simple tubes lined with cells or of branched tubes, or of tubes dilated laterally into little acini or groups of bags, the arrangement then somewhat resembling that of a bunch of grapes. There are sometimes large sacs or reservoirs connected with the efferent tubes proceeding from the secreting portions of the glands. The salivary glands ultimately discharge into the mouth, so that the fluid secreted by them has to be swallowed in the same manner as the food, not improbably along with it" (Sharp). In *Anophthalmus* there are three pairs of salivary glands, while in *Blaps* they consist of a number of ramifying tubes united on each side of the œsophagus into a single duct. The silk glands are probably modified salivary glands. They consist of very long tubes similar in form and situation to the simple tubes of the salivary glands, and are found chiefly in the larvæ of the Lepidoptera, but also occur in certain CHRYSOMELIDÆ (*Donacia* and *Hæmonia*) and in *Hypera* among the CURCULIONIDÆ.

The Nervous System.

The nervous system consists primarily of a series of ganglia or nerve-centres united by one or two cords of nervous matter. The whole system is very complex and comparatively little is known with regard to many of the minor details. It may conveniently be treated as consisting of the three following divisions :—

1. *The ganglia of the head*, sometimes called the *cephalic system*. Of these ganglia there are two, a large one above the œsophagus, called the supra-œsophageal ganglion, and a small one below the œsophagus, called the infra- or sub-œsophageal ganglion. In the Coleoptera and many other insects these are very closely approximated. They may be regarded as part of a single great ganglionic chain, but are best dealt with separately owing to their complex

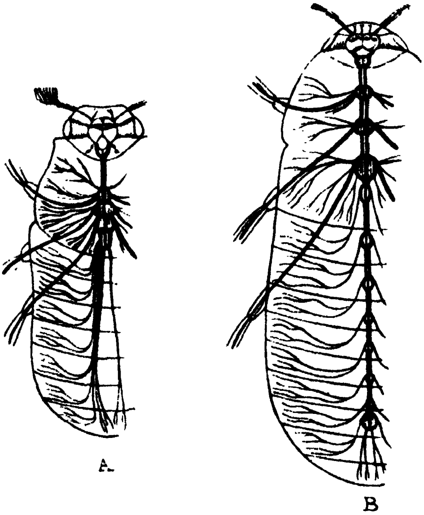

Fig. 7.—Nervous system, (A) of *Serica brunnea*, ♂ (Scarabæidæ), showing the concentration of the ganglia, and (B) of *Dictyopterus sanguineus*, ♀ (Lycidæ), shewing the decentralisation of the ganglia. (After Brandt.)

structure. Taken together they correspond more particularly with the brain of the vertebrate animals, and their structural development and complexity appears to be correlated with superior intelligence, such characteristics being very strongly marked in the Ants and other Hymenoptera.

2. *The ventral ganglia.* These are, of course, very closely connected with the ganglia of the head. They differ very greatly in number in different insects and even in the larva and the perfect insect of the same species, this difference being due to the greater or less amount of concentration.

It is generally assumed that in the primitive insect each segment had a simple ganglion, but some of these, in the course of the development of the orders, have become amalgamated. This concentration is, as Dr. Sharp and others have pointed out, "concomitant with a more forward position of the ganglia," and is very evident in the SCARABÆIDÆ, in which, for the most part, there are no ganglia at all situated in the abdomen, all the abdominal ganglia being joined to the ganglia of the metathorax. This has been regarded as one reason for assigning a high position in the order to the LAMELLICORNIA; but this cannot be pressed, as the LUCANIDÆ have six or seven ventral ganglia. The character, however, serves strongly to emphasize the complete difference that exists between the LUCANIDÆ and SCARABÆIDÆ. The question of the composition of the ventral chain is an important one, as it is now becoming more extensively used as a help towards classification.

3. *An accessory sympathetic system (or systems).* This links up various organs of the body with the general nervous system, but apparently not very much is known with regard to it, except in isolated cases. The frontal ganglion, shown in fig. 7, is a starting point for one portion of this system, which is then connected with the brain system, and extends to the proventriculus, the series being known as the stomato-gastric system.

The Circulatory System.

The blood has no red corpuscles but contains pale amœboid cells corresponding to the white corpuscles (leucocytes) of the vertebrates. The organ which answers to the heart, and which, functionally only, may be regarded as a true heart, is a dorsal vessel, consisting of a delicate, pulsating tube, situated above the digestive canal and divided into several chambers, arranged longitudinally and opening one into the other. These by their alternate contraction and dilatation (which may easily be observed in transparent larvæ), distribute the blood through the so-called blood-vessels, which soon open into the hæmocœl or perivisceral space. The dorsal vessel is nearly always closed behind, but is open in front and is provided with apertures at the sides;

these vary in number, four, for instance, occurring on each side in *Calosoma*, and eight in *Melolontha*. These apertures are usually absent from the front part of the tube which is, somewhat wrongly, called the aorta; near the lateral apertures are folds, called sometimes the alar valves, which assist in the circulation of the blood; beneath the dorsal vessel is a delicate membrane and connected with this (which forms a *pericardium*) are delicate muscles, called the alary muscles. This membrane is fenestrated, and when depressed the blood passes through its pores and thus reaches the heart.

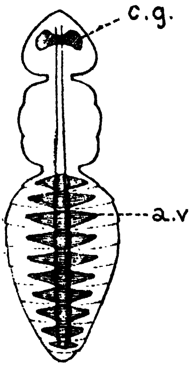

Fig. 8.—Circulatory apparatus of a beetle; *a.v.*, alar valves; *c.g.*, cephalic ganglion. (After Berlese.)

The heart, according to Graber, "is nothing more than a regulator, an organ for directing the blood in a determinate course in order that it may not wholly stagnate, or only be the plaything of a force acting in another way, as, for example, through that afforded by the body-cavity and the inner digestive canal. At regular intervals a portion of the blood is sucked through the same, and then, by means of the anterior supply tube it is pushed onward into the head, whence it passes into the cavities of the tissues. The different conditions of tension under which the mass of blood stands in the different regions of the body then cause a further circulation."

Connected with the general system there appear to be smaller pumping apparatuses, by means of which a regular flow of blood is kept up in the limbs, wings, antennæ, etc. (*cf.* Packard, Text-Book of Entomology, p. 402).

The Respiratory System.

Burmeister (Manual of Entomology, p. 158) says:—"We shall find the respiratory organs of insects as complex and perfectly developed as we have found their blood-vessels simple and imperfect. The relations between these systems appear to be in them completely reversed, for the air-vessels intersect the insect body as multitudinously as we find the blood-vessels do in the superior animals." There are no lungs, but the whole body is pervaded with air by means of tracheæ, which are tubes of very variable size, those connected with the external openings, called the stigmata or spiracles, being the larger main channels. From these latter smaller channels proceed, and from these again originates a network of still smaller tubes, forming ramifications through all the organs inside the body.

There are also present in flying insects (although not in larvæ) air-sacs connected with the tracheæ. It has been supposed that the use of these sacs is to lighten the weight, but this is erroneous, for, as pointed out by A. A. Packard, it is evident that the wings have to support just as much weight when the insect is flying, whether the tracheæ and sacs are filled with air or not; the case, of course, would be different were they filled with hydrogen gas. The real use of the sacs, some of which are very large, is to afford a greater supply of air, and therefore of oxygen, than that contained in the air-tubes alone, and thus to afford a greater breathing capacity. This is further proved by the fact that the sacs are largest in the more swiftly flying insects, such as moths, flies and bees, whose greater exertions create a demand for a more abundant amount of air.

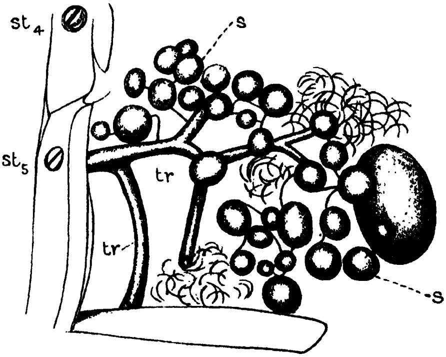

Fig. 9.—Tracheal sacs connected with the third abdominal segment of *Geotrupes sylvaticus*. st_4, fourth stigma or spiracle; st_5, fifth stigma or spiracle; *tr*, branches of the tracheæ; *s*, air-sacs. The thread-like parts represent fat-bodies. (After Kolbe.)

The stigmata or spiracles, as a rule, can be opened or closed at will by means of muscles, but in some cases are only protected by short hairs or hairy tufts. In the Coleoptera each segment of the body (except the head and, as a rule, the last segment) has a spiracle, or, more correctly, there is a spiracle on the boundaries of each of the segments; the shape and position of these organs sometimes afford a good character for classification (as in the DYTISCIDÆ and SCARABÆIDÆ). Gills or branchiæ are rarely found in the order, so far as the perfect insects are concerned; they occur, however, in many larvæ (e. g., *Gyrinus*, *Hydroüs*, *Berosus*, etc.), in the form of processes arising from the sides of the segments. All water insects which are not provided with gills or corresponding organs have to rise more or less frequently to the surface of the water in order to obtain the requisite supply of air, which they, in most cases, draw more especially through the spiracles situated at the posterior end of the body. It is astonishing, however, how very little air suffices for some insects. I have kept *Eubrychius velatus* (a well-known small British water-frequenting weevil, which swims like a Dytiscid) in a very small tightly corked tube of water for some days, and it was none the worse. I did not observe any air-bubble at its posterior end, as is often seen in the Dytiscidæ and various aquatic insects when they come to the surface. The amount of immersion that beetles will stand in a flood shows how very different the function of their respiratory system must be from those of the Vertebrates. Probably the tracheæ and sacs ramifying throughout the body contain air sufficient to support life for a considerable time in cases of necessity. The fact that Coleoptera can stand a long immersion has, of course, a very important bearing upon the question of their distribution.

The Organs of Reproduction.

The external organs of reproduction consist of a male intromittent organ and a female receptacular organ and ovipositor, the sexes being always separate. These structures are very varied in form, and should not be spoken of in the terms applied to vertebrate animals, as is usually the case, for, especially in the male, there is no analogy whatever in structure and very little in physiology; the best term to apply to the male organ and its appurtenances is the ædeagus. The chief internal organs of the female are the ovaries or clusters of egg-tubes; these clusters are two in number and are situated one on each side of the body. The tubes vary very much in number; they fill the space of the abdomen not occupied by the alimentary canal, and are suspended to the tissues connected with the "heart" by thread-like terminations. The formation of these organs has been made use of by several recent authors as an important character in the classification of the Coleoptera, in which order one or more

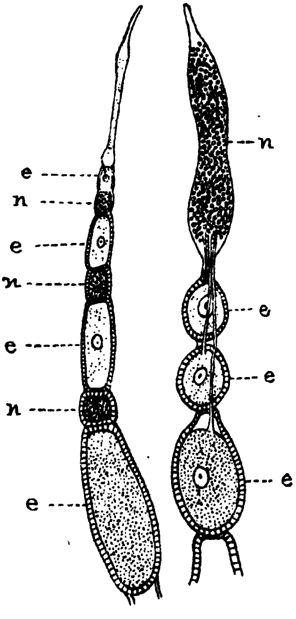

Fig. 10.—Ovarian tubes. Meroistic (on the left); holoistic (on the right); *e*, egg-chamber; *n*, nutriment chamber. (After Lang.)

nutriment chambers (Nährkammern) are always present. In the ADEPHAGA there are several such chambers alternating with the egg-chambers, and the ovaries in such cases are called meroistic; but in the other Coleoptera, so far as is known, the terminal chamber is developed into a large nutriment chamber, and there are no others; the ovaries in this case are said to be holoistic. In certain orders of insects, there are, in many instances, no nutriment chambers at all; such is the case with various Hymenoptera.

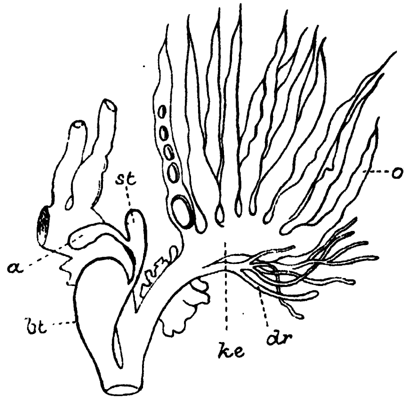

Fig. 11.—Reproductive organs of the female of *Hydrobius fuscipes*. *ov*, ovary (the left ovary is cut off in the figure); *ke*, oviduct, enlarged in front; *dr*, accessory glands; *bt*, copulatory pouch; *st*, seminal pouch or spermatheca; *a*, accessory gland of the same. (After Graber.)

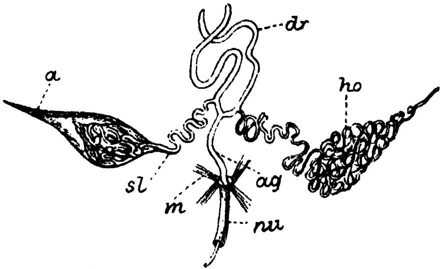

Fig. 12.—Reproductive organs of the male of *Staphylinus erythropterus*. *ho*, testicle (the covering envelope or capsule is shown at *a*); *sl*, vas deferens; *ag*, ductus ejaculatorius; *dr*, accessory glands; *nu*, ædeagus; *m*, muscles. (After Graber.)

These facts were pointed out by Korschelt and Heider. Ganglbauer and others are of the opinion that the ovaries with the single and well developed terminal egg-chamber represent a higher and more differentiated type, but this is open to question. The other important female organs of reproduction are the vagina leading to the copulatory pouch and the spermatheca or receptaculum seminis.

In the male the chief internal organs which answer to the ovaries of the females are the testes, the secretion from which is conveyed by the vasa deferentia into the vesiculæ seminales. The two testes may consist of simple coiled tubes or of a number of follicles opening into a common tube; these are often contained in a capsule. In the ADEPHAGA the tubular structure is found, whereas in the rest of the Coleoptera they appear to be follicular; it must, however, be admitted that hardly a sufficient number of species have been dissected to justify a very wide generalisation in this respect. The vasa deferentia are fine tubes, varying very much in length (in *Dytiscus* they are five times, and in *Cetonia aurata* thirty times as long as the body), and they are furnished with accessory glands, consisting of tubes, the secretions of which mix directly with the semen. The majority of Coleoptera possess one pair, but several pairs are present in some families (*e. g.*, HYDROPHILIDÆ and ELATERIDÆ). Several of these points will be

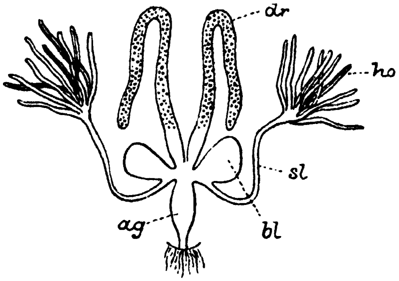

Fig. 13.—Reproductive organs of a male bark-beetle. *ho*, testicle; *sl*, vas deferens; *bl*, seminal vessel; *ag*, ductus ejaculatorius; *dr*, accessory gland. (After Graber.)

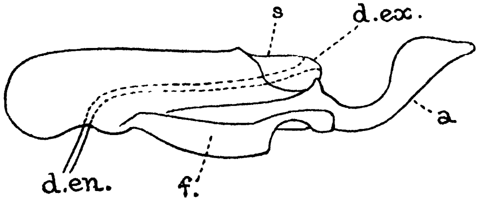

Fig. 14.—Ædeagus of *Philonthus nigritulus*, ♂. *d.en.*, duct entrance; *d.ex.*, duct exit; *s*, sac; *f*, furca; *a*, appendage. (Original from drawing by Sharp.)

again alluded to under classification; they have been particularly worked out by Bordas (Ann. Sci. Nat. (8) xi, 1900, pp. 283-448); Léon Dufour ("Recherches anatomiques sur les Carabiques, etc.," Ann. Sci. Nat. (1) vi, 1825, p. 152); and Escherich ("Anatomische studien über das männliche Genitalsystem der Coleopteren," Zeitschr. für wissensch. Zoologie, lvii, 1894, pp. 620-641, Taf. xxvi).

There are many secondary characters belonging to the male. Some of these, which might be called direct characters, are adaptations for holding the female, *e. g.* the dilated front tarsi of many CARABIDÆ, the suckers of the front tarsi of the DYTISCIDÆ, the enlarged and toothed femora and curved tibiæ which occur in various genera; while others, which might be termed indirect characters, consist in considerable differences in length and breadth (the male being often much smaller than the female), longer and more serrate or plumose antennæ, a greater development of the head and its appendages (especially in the LAMELLICORNIA), etc. These will be noticed in the course of the work.

Dimorphism within the limits of a single sex is of rare occurrence, but we have a good instance of it in the elytra of the females of certain DYTISCIDÆ, which may be either smooth or deeply canaliculate in the same species.

The Organs of Sense.

The organs of sight.—These, in the Coleoptera, are of two kinds, the compound facetted eye, and the simple eye or ocellus, which is only found in the imago of a few species, and then in conjunction with the compound eye (as in *Omalium*, etc.). Some of the cave-

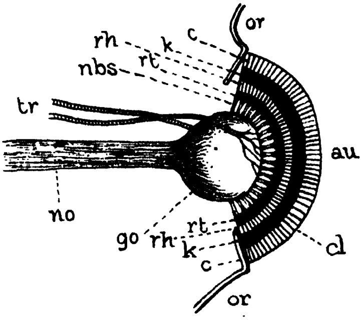

Fig. 15.—Diagrammatic section of the eye of a beetle. *au*, facetted eye; *c*, transparent cornea made up of numerous lenses (*cl*); *k*, layer of crystalline cones concealed by pigment; *rh*, *rt*, rhabdoms and retinulæ, partly concealed by pigment; *nbs*, nervous structures; *go*, globular apex of the optic nerve; *no*, optic nerve; *tr*, two tracheæ belonging to the optic nerve; *or*, part of the chitinous orbit of the eye. (After Kolbe.)

frequenting beetles (as *Anillus*), are blind, and only possess quite rudimentary organs of vision.

The compound facetted eye is one of the most intricate and wonderful structures in the whole animal kingdom. Each facet is the outside covering or cornea of an elongate and complex apparatus called an ommatidium (fig. 16), each consisting of a corneal or crystalline lens (*cor.*), under which comes the crystalline cone (*con.*), which is borne on a rodlike structure or rhabdom (*r.*); underneath the rhabdoms is found the basal or fenestrated membrane (*b.m.*), which is backed by a mass of nerves; these latter penetrate the membrane and run up into the space between the rhabdoms. According to Sharp and others the penetrating nerve have their distal extremities connected with the delicate sheaths, by one of which each rhabdom is surrounded, the combination of sheath and nerves forming a retinula. Two zones or layers of pigment are present, one, in which the pigment cells are shorter, enclosing the chief part of the crystalline cone, called the iris-pigment, and the other, in which the pigment cells are longer, surrounding the lower part of the retinula and called the retina-pigment; the nerve-fibres are branches of the optic nerve. Tracheæ or air passages also pass through the fenestrated membrane.

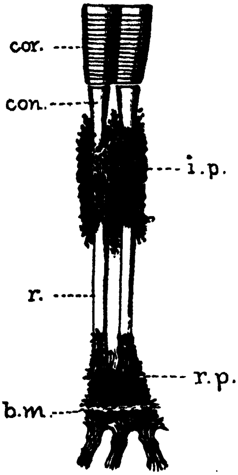

Fig. 16.—Two ommatidia from the eye of *Colymbetes fuscus*. *cor.*, cornea; *con.*, crystalline cone; *r.*, rhabdom; *b.m.*, basal membrane, with nerve structures beneath; *i.p.*, iris-pigment; *r.p.*, retina-pigment. (After Exner.)

The ommatidia vary in number very greatly, and in some beetles (e. g. *Mordella*) the eye is said to contain as many as 25,000. In some families and tribes they vary in different species, and this variation (of finely or coarsely facetted eyes) has been made use of occasionally (as in the Languriinæ) as a generic character.

The structure of the ocelli or simple eyes is very different. They consist of a cornea, lens, nerve-fibres, and a retina, together with pigment cells; they are the ordinary organs of vision of Coleopterous larvæ, but are very rarely found in the perfect beetles. The function of the ocelli has been much disputed, but according to Lubbock and Forel, followed by Packard, Folsom, and others they are useful in dark places and for near vision. The last named writer (Entomology, with special reference to its Biological and Economic Aspects, 1906, p. 111) says: "Since the form of the lens is fixed and also the distance between the lens and the retina there is no power of accommodation, and most external objects are out of focus; to make an image, then, the object must be at one definite distance from the lens, and as the lens is usually strongly convex, this distance must be small." Insects with ocelli only must therefore be very short-sighted, and probably in a great number of cases the ocelli are only serviceable in distinguishing light from darkness and so giving warning of any sudden movement or approaching obstacle by the alteration of the light.

The mode of vision by facetted eyes is a much more difficult problem. Müller's so-called mosaic theory is, at present, most generally accepted, although it does not seem altogether satisfactory; it is as follows:—"An image formed by several thousand separate points, of which each corresponds to a distinct field of vision in the external world, will resemble a piece of mosaic work, and a better idea cannot be conceived of the image of external objects which will be depicted on the retina of beings endowed with such organs of vision, than by comparing it with perfect work of that kind." The use of such an eye is to perceive movements rather than form. As remarked by Packard, most animals seem but little impressed by the form of their enemies or their victims, though their attention is immediately excited by the slightest displacement. Hunters, fishermen, and entomologists have made, in confirmation of this view, numerous and demonstrative observations. Gottsche and others favour the view of a separate and distinct image for every cornea, *i. e.* for every facet. Lubbock, who favours Müller's theory, gives a long list of reasons opposed to this view, but his last reason seems sufficient for practical purposes, viz.: "that a combination of many thousand relatively complete eyes seems quite useless and incomprehensible."

The organs of smell appear to be chiefly found in the antennæ, although some of the structures, evidently connected with this sense, that have been observed in these have been regarded by various writers as organs of hearing. There can, however, be no doubt that many of the structures are really olfactory, as this has been proved by various experiments, especially those made by Hauser ("Physiologische und histologische Untersuchungen über das Geruchsorgan der Insecten," Zeitschr. f. wiss. Zool. xxxiv, 1880). Taking a glass rod dipped in carbolic acid and holding it at some little distance from a specimen of *Philonthus æneus*, the beetle raised its head, turned it in different directions, and made lively movements with its antennæ. When the rod was placed closer, it started back and ran in the opposite direction; when the rod was removed it occupied itself for some time in drawing its antennæ, with the aid of the fore limbs, through its mouth, although it had not touched the acid. The antennæ were then removed, and the day after the experiment was repeated without any effect upon the insect. The same results have been produced by the more humane method of placing the antennæ in liquid paraffin wax, and so covering them with a layer of wax and excluding the air, instead of removing them. Experiments performed on insects of various orders gave much the same results. Some lived for months, without apparently suffering inconvenience, after the extirpation of the antennæ, while others died in a few days. In all cases, however, they appeared to have lost the sense of smell only. Experiments bearing on the use of the antennæ in seeking food were also made with *Silpha* and certain flesh-flies. The strong-smelling food was only discovered by the insects while in possession of antennæ; without them they failed to localise it. *Bolboceras* (GEOTRUPIDÆ) has been observed unerringly discovering truffles, and this it must do by the aid of smell, as they are found at some distance underground.

The actual organs of smell appear to consist in most cases of pits on the antennæ connected with nerve rods and a ganglion cell; they are not, apparently, so numerous or important in the Coleoptera as in other orders, yet they are found distinctly in *Silpha*, *Necrophorus*, *Staphylinus*, *Philonthus*, *Tenebrio*, and the LAMELLICORNIA. According to Arrow (Fauna Brit. Ind., Col., Lamell., i, p. 1) the apposed faces of the fan-like leaves or lamellæ in the last-named group are furnished with minute sensory pits and hairs which are freely exposed to the air when the beetle is in motion. Smell and hearing therefore, if such senses exist, are probably well developed in the antennæ of the LAMELLICORNIA. The sensory pits have not yet been satisfactorily traced in the CARABIDÆ, CERAMBYCIDÆ, CURCULIONIDÆ, CHRYSOMELIDÆ, or MELOIDÆ. It is probable that other olfactory organs exist on the palpi or other portions of the head or body of various insects.

The organs of taste appear to consist of very small pits or cups or of hair-like or peg-like setæ situated on the epipharynx, which have been proved by Will and others to be connected with ganglionated nerves. These are very generally distributed in the Coleoptera, and occur not only in the adult beetles, but also in the larvæ of several groups. The taste organs of the CICINDELIDÆ differ entirely from those of the CARABIDÆ, and are peculiar to the group. In the latter family they are well developed, as they are also in the DYTISCIDÆ, the PHYTOPHAGA, and the SCOLYTIDÆ. In the BUPRESTIDÆ no true taste cups have been detected; in the SCARABÆIDÆ they occur in some instances and not in others; while in the LONGICORNIA they are always found without any known exception.

The organs of hearing.—The fact that Coleoptera produce sounds by stridulation, tapping, etc., seems to prove that they must possess auditory organs of some sort. It must, however, be allowed that Huber, Perris, Forel, and other authorities deny their existence, claiming that the so-called "hearing" is merely tactile. The various stridulating contrivances will probably be noted by writers on the different groups, as they are occasionally very useful characters in classification, *e. g.*, in the LONGICORNIA, in certain EROTYLIDÆ (LANGURIINÆ), etc. A good account of these organs, so far as they were then known, is given by Darwin (Descent of

Man, 1st Edition, Vol. i, 1871, pp. 378–385); and Landois discusses them in detail in his 'Thierstimmen' (Freiburg, 1874). Mr. Gahan has more recently published an excellent paper entitled "Stridulating Organs in Coleoptera" (Trans. Ent. Soc. Lond. 1900, pp. 433–452), in which he divides them under four heads, as follows:—

1. Stridulating organs on the head (p. 434).
2. Stridulating organs on the prothorax and front legs (p. 441).
3. Stridulating organs in the mesothorax and middle legs (p. 443).
4. Stridulating organs in the hind legs, elytra, and abdomen (p. 446).

In one form or another these organs are found in a large number of families (CICINDELIDÆ, CARABIDÆ, DYTISCIDÆ, ENDOMYCHIDÆ, HETEROCERIDÆ, ELATERIDÆ, CERAMBYCIDÆ, CHRYSOMELIDÆ, CURCULIONIDÆ, SCOLYTIDÆ, etc.), but appear to be chiefly developed in the LAMELLICORNIA, in which sub-order many of the larvæ have the power of stridulation, as well as the perfect insect; several of these appliances in the larvæ are figured by Schiödte (Naturhistorisk Tidsskrift, Ser. 3, Vol. ix). Dr. Ohaus and Mr. Arrow have done much to increase our knowledge of these structures, and their work will be alluded to more in detail under the LAMELLICORNIA.

The BOSTRYCHIDÆ and ANOBIIDÆ produce, in several instances, tapping sounds, but some of their members appear to have a stridulatory apparatus as well. On this point, Mr. Gahan writes as follows:—"In the genus *Anobium* proper, the gula is less extensive than in *Priobium*, and has no trace of a stridulating area, but in many of the species there is a curious series of ridges on the underside of each elytron close to its outer and apical margin, suggesting that the elytra may in these cases be used for purposes of stridulation. These ridges are not present in *Priobium* and are wanting also in *Xestobium tessellatum*, one of the species which are known to make a noise by tapping their head against the wood on which they stand."

The beetles belonging to the curious Longicorn genus *Plagithmysus*, from the Hawaiian Islands, appear to have three means of stridulating; firstly, by moving the edge of the prothorax over a striated area on the mesosternum; secondly, by means of a stridulating file along the lateral edge of each elytron against which they rub the hind femora; and thirdly, by means of a series of ridges which is present on each of the middle and hind coxæ; these are in some species very regular and parallel, and are considered by Dr. Sharp, who discovered them, to be true stridulating structures (*v.* Gahan, *l. c.* p. 446).

Several beetles produce a loud humming noise; this is partly caused by the wings, but is also due to a chitinous process in the large trachea, just behind the spiracle, which is thrown into vibrations by the air during respiration. This is found in the cockchafer, and the well known boom of the dor-beetle (*Geotrupes*) is evidently due to it.

The whole question of the auditory organs in insects is a very obscure one. Graber (Denks. Ak. Wien, xxxvi) has discovered that extirpation of tympaniform organs does not diminish the effect of sounds in the case of the Orthoptera, and this much modifies our ideas with regard to the organs in this order. It is probable that if a true auditory sense exists in the Coleoptera, it will prove to be connected with the characteristic isolated setæ which are found in so many beetles, and are evidently of great importance in their economy. These setæ are in close connection with important nerves and are probably sensitive to vibrations (especially such as would be caused by stridulating organs) as well as to actual touch. It is probable that some of the strange structures found in the antennæ of insects may have to do with hearing as well as other functions. Lubbock (Ants, Bees, and Wasps, pp. 226–227) considered that certain curious organs in the antennæ of ants were very probably auditory organs, although he has elsewhere stated that some ants, like the Orthoptera, have organs of hearing on the tibiæ. As, however, he failed to prove by his experiments that these insects have any auditory powers, the truth of this hypothesis is doubtful.

It is quite possible that similar structures, which seem evidently to be connected in some way with the senses, may be found in the Coleoptera, although none have been hitherto observed. It is not impossible also that the antennal pits in *Adelops*, *Melolontha* and other LAMELLICORNIA, the BUPRESTIDÆ, etc., have to do with hearing or with smell, or even with a sense of which we know nothing.

The sense of touch in the order is evidently very highly developed. The special setæ, before referred to, are certainly most sensitive, and they are so constant that specific or even generic or divisional characters have been founded upon them by some authors. These setæ are very common in the CARABIDÆ, STAPHYLINIDÆ, etc., but, so far as is at present known, do not occur in any LAMELLICORNIA except in the somewhat abnormal genus *Aclopus*, in which the dorsal surface of the pronotum is quite free from hairs except for one or two placed in sensory pits on each side of the middle line.

The antennæ are, evidently, to a great extent, tactile organs, and the setæ with which they are furnished must greatly increase their sensibility, these setæ being also found, to a greater or less extent, on the legs and abdomen. So many beetles live in the dark that they must necessarily possess such sensitive tactile organs.

Before leaving the subject of the organs of sense in the Coleoptera it is perhaps necessary to say that the terms adopted are merely provisional, and that although insects appear plainly to have the organs of sight and touch well developed in a manner analogous to, yet in many points differing from, what we find in the Vertebrates, yet we know nothing, as a matter of fact, about their other senses, which may be entirely different from anything of which we have any conception. We can only pick out certain structures and say that they have apparently to do with smell, taste, or hearing, but we may be quite mistaken. In fig. 17, some of these organs are represented. We have first (A) the apex of the antennæ of a larva of *Pentodon punctatus* (DYNASTINÆ), with a sensory plate (*a*) and sensory hairs (*str*), and also the apex of the palpus of an adult *Melolontha* (B), with sensory hairs or setæ; we cannot, however, say with certainty whether these have to do with smell, taste, or hearing. One of the antennal pits of *Melolontha vulgaris*, seen in a vertical section, is represented at C. These pits, which occur commonly in the LAMELLICORNIA, have been referred to above; they are very remarkable both for their structure and their number. Packard says of them (Text-Book of Entomology, p. 275):—"On the outer surface of the first and seventh (in the female the sixth) antennal leaf, as also on the edges of the other leaves, only arise scattered bristles; on the inner surface of the first and seventh leaves, as also on both surfaces of the second to the sixth leaves, are close rows of rather shallow depressions of irregular form, some circular, others regularly hexagonal. Their number is enormous; in the males 39,000, in the females 35,000, occur on each antenna." We cannot, however, say what their real sensory function is, although it is quite evident that it is very important; it may be auditory or it may be olfactory, or both. Curious antennal teeth occur in *Dytiscus* and in the blind Carabid *Anophthalmus*; some of these, on the edge of the antennæ, are shown at D. These teeth are interpreted by Packard as organs of smell, but they may be organs of hearing or even of taste, like the minute

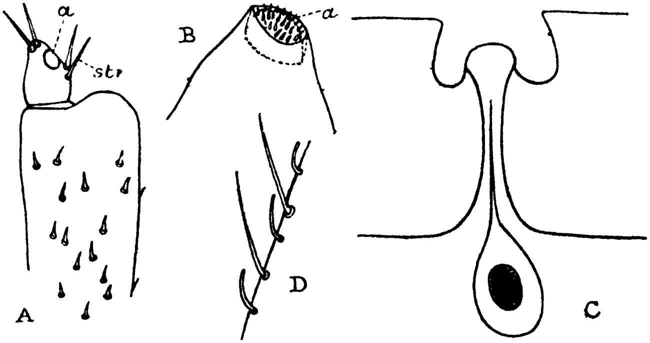

Fig. 17.—Organs of sense in Coleoptera:—A. *Pentodon punctatus*, apex of antenna of larva; *a*, sensory plate; *str*, sensory hairs. B. *Melolontha*, apex of palpus. C. Antennal pit of *Melolontha vulgaris*. D. Antennal teeth of *Anophthalmus tellkampfii*. (After Berlese and Hauser.)

discs which are found on the palpi of certain species of *Carabus*, surrounded by a large number of minute teeth. The whole question, at present, rests largely on pure hypothesis.

Coloration.

The colours of Coleoptera vary as much as their size and form. The most brilliant are, perhaps, the BUPRESTIDÆ and the CETONIIDÆ; but the CICINDELIDÆ and many of the CHRYSOMELIDÆ and their allied groups, and many also of the LONGICORNIA, run these very close in beauty of colour. The brilliant metallic colours may be either entirely structural, or else due to a combination of structure and pigment. The structural colours of Coleoptera probably belong, for the most part, to the category of interference colours, such as are seen in a soap-bubble. Colours of this kind are produced by thin films of air, or of liquids of low refractive power, included between layers of a horny consistence. If the films consist of air, the colour remains unaltered in dry specimens; if, however, they are liquid, as the tissue dries up so also do the films, and the colour disappears. This is very evident in insects like the CASSIDIDÆ, which, in their native tropical habitat, are among the most brilliant of beetles, and glitter like large dewdrops in the sun with shining metallic or opalescent colours, but in our collections present a uniformly faded appearance. If, however, they are kept in spirit or water, they retain their colour. Such colours may even fade and be restored in a living beetle, for it has been observed that a brilliant golden beetle (*Carabus auronitens*) lost all its lustre after hybernating in captivity, but regained it after drinking some water. Many metallic colours are also due to diffraction (caused by white light being reflected from a number of fine parallel grooves) or refraction (prismatic colours). The general subject will be found discussed in Professor Poulton's 'Colours of Animals' (International Science Series, pp. 1–11), to which work I am indebted for the chief part of the foregoing observations.

Mimicry and Protective Resemblance.

In my Presidential Addresses to the Entomological Society of London in 1902 and 1903 I dealt partly with the question of Mimicry and Protection among the Coleoptera, a subject which had been comparatively neglected in this order, although it had been for a long time brought into strong notice so far as the Lepidoptera were concerned. It may perhaps be useful to recapitulate briefly the chief points noticed, as observers in the field will certainly be able to add a vast number of interesting facts if they will only make note of them as they occur. Indeed, it is only the field-workers who have really any right to speak on the matter, as theorizing on possible resemblances and adaptations to surroundings in museums, though often very useful, is liable to be inaccurate, and may lead to erroneous deductions. We have, however, sufficient actual observations to prove that there must be a great deal of significance in many of the resemblances and other apparent means of protection, even though that significance may have been exaggerated in some instances.

1. The assimilation of colour to environment is found running through the whole animal kingdom, and is especially marked in large numbers of Coleoptera, more particularly in those that live on or about wood or bark. We find the best instances among the LONGICORNIA and RHYNCHOPHORA, whole groups of which closely resemble the bark of the trees on which they live. A striking case of this kind of cryptic resemblance is found in the large and handsome African Longicorn, *Petrognatha gigas*; not only does its upper surface resemble dead velvety moss such as is found on tree-trunks, but its long antennæ are exactly like dry tendril-like twigs. The same kind of protective resemblance is found in *Saperda*, *Lamia*, and other genera; while the weevils belonging to the genus *Lithinus* (from Madagascar) so closely resemble the lichen-covered twigs on which they live that they can hardly be seen by an unskilled observer, even when pointed out. Several CICINDELIDÆ are exactly adapted to their environment, and can hardly be distinguished from it unless in motion; and there are very few groups in which these resemblances do not occur. Many of the weevils fall and feign death at the least alarm, and as they fold their legs and rostrum closely on the body, they look like small seeds or bits of dry earth, and easily escape observation. This cryptic folding of the limbs and feigning death is also found among the BYRRHIDÆ and certain sections of the STAPHYLINIDÆ, and is a very effective method of protection.

2. Many beetles which are distasteful exhibit bright warning colours, which render them conspicuous, and thus serve to advertise their unpleasant qualities. Among these may be especially mentioned the COCCINELLIDÆ, TELEPHORIDÆ, and LYCIDÆ. Others adopt warning attitudes, such as *Ocypus olens*, *Broscus*, *Anthia*, etc.; it must be remembered that there is always some actual means of defence behind these colours and attitudes, consisting in the power of emitting unpleasant secretions or inflicting a severe bite, in case the warning is neglected. The question of warning sounds is a very interesting one, but at present very little is known about it. Mr. Guy Marshall, however, has proved that both a kestrel and a baboon showed evident alarm at the stridulation of a Longicorn beetle.

3. Distasteful insects are often imitated by edible species belonging to the same or a different order. I have before given a considerable number of instances of this mimicry in the case of the Coleoptera (Proc. Ent. Soc. Lond. 1901, p. li), and need not here recapitulate them. Occasionally not only the appearance but the general habits and movements of the insect are copied, as in the case of the wasp-like Longicorn, *Clytus arietis*, which, unlike its usually sluggish relatives, runs swiftly up and down the leaves

on which it settles, just like a wasp hunting for food. Many beetles, especially the many inquilines of ants' nests, resemble ants; the curious little Carabid, *Eya* (*Selina*) *westermanni*, from Ceylon, is exactly like a small black ant (*vide* p. 58), and others from various groups (LONGICORNIA, LAMELLICORNIA, STAPHYLINIDÆ, etc.) bear a close resemblance to hairy bees. Occasionally a beetle possessing offensive qualities is imitated by a more defenceless insect of another order.

It is well known that certain groups of insects of various orders in a single district often present a uniform scheme of colour, which evidently has a warning significance. This is called Synaposematic or Common Warning Coloration. The subject is fully discussed and well illustrated in an excellent paper by Mr. Guy Marshall (Trans. Ent. Soc. London, 1902, part iii, pls. xviii & xix). The chief families of Coleoptera which enter into synaposematic combinations appear to be the following:—MELOIDÆ, MELYRIDÆ, CANTHARIDÆ, COCCINELLIDÆ, EROTYLIDÆ, ENDOMYCHIDÆ, CHRYSOMELIDÆ, and CLERIDÆ.

The facts of mimicry, protective resemblance, warning colours, etc., have perhaps been too much emphasized and given a significance which they will not altogether bear; but, on the other hand, they are in many instances so striking that they cannot be explained away as mere matters of coincidence. But there is much need of more field-work on these subjects; exact observations are required as to the natural relations which subsist between these mimicking species and their models, as well as judicial and carefully devised experiments which shall adequately test those theories that have been advanced to explain these remarkable resemblances. As yet very few have done such work in India, but their numbers are increasing, and a rich and interesting harvest awaits them.

Metamorphosis.

The metamorphoses of the Coleoptera are considered as complete, and for such insects the term Holometabola has been proposed. The pupæ, however, are almost always very soft, and their appendages are not fastened to the body, differing notably in this respect from those of the Lepidoptera. Some pupæ, however, as pointed out by Dr. Sharp and others, are truly obtected, having a hard shell and the rudimentary appendages fastened by exudations to the body, like Lepidopterous pupæ; these belong to the STAPHYLINIDÆ. Others, again, are intermediate between the latter and the ordinary pupæ. The larvæ of Coleoptera are extremely variable in form and habits; many of these will be noticed during the course of the work; comparatively little is known about their life-history as they are, except in the case of the wood-feeding species, very difficult to rear. As might be expected, the predatory larvæ (CARABIDÆ, DYTISCIDÆ, STAPHYLINIDÆ, etc.) are, as a rule, very active; this is not, however, always the case, as the larvæ that construct burrows and lie in wait for their prey (CICINDELIDÆ) are not adapted for rapid motion. Those that live surrounded with their nutriment (SCARABÆIDÆ, many RHYNCHOPHORA, etc.) are usually sluggish. As a rule the six legs are fully developed, although occasionally one pair may be rudimentary and adapted for a special purpose (as in the PASSALIDÆ). Sometimes they are very small, and in the CURCULIONIDÆ they disappear altogether. This is not the case with all the RHYNCHOPHORA, as appears to be sometimes thought, for in the ANTHRIBIDÆ the larvæ of some of the genera are legless, whereas in others legs are present (e. g. *Cratoparis* and *Aræocerus*); while in the larva of the curious European species *Choragus sheppardi* the legs are replaced by three pairs of thoracic sac-like pseudopods (Sharp, *l. c.* p. 290). Probably in most of the apodous species the rudiments of legs might be found underneath, if not outside, the integument, if the insects were dissected and microscopically examined.

There are two forms of Coleopterous larvæ:—1. the Campodeiform or Thysanuriform; 2. the Eruciform or grub-form. The first of these is the active form, with long legs (as a rule), and well-developed, usually predaceous, mouth-parts; this form is considered the more primitive. Besides the predatory beetles above alluded to, the first instars* of STYLOPIDÆ and MELOIDÆ are campodeiform.

In 1869 Brauer first suggested that the larvæ of a great number of insects may be traced back to such primitive insects as *Campodea* and *Iapyx*, belonging to the order Thysanura. He also pointed out that most of the more highly developed insects assume another larval form, which appears as a later acquisition, through adaptation to certain definite conditions. In the case of *Sitaris*, *Meloë*, and *Epicauta* we see the adaptation take place before our eyes. This second form is the eruciform, grub-, or maggot-like larva. Brauer rightly considers that this form resulted from the insects living a stationary, semi-parasitic life on plants, in carrion, etc., where they had no need to go far afield in search of food. The majority of the Coleopterous larvæ belong to this second division, with greater or less modifications.

There is, in many instances, a striking similarity among the larvæ of Coleoptera belonging to the same family, and this is not only the case in those families in which the perfect insects bear more or less resemblance to one another, such as the CARABIDÆ, STAPHYLINIDÆ, ELATERIDÆ, etc., but among groups in which the imagines differ entirely in facies. This is particularly noticeable in the case of the TENEBRIONIDÆ, the larvæ of which, as a rule, are elongate, linear, parallel-sided, flattened, or cylindrical grubs, presenting a very close superficial inter-resemblance; and this is more or less maintained (with exceptions) throughout the HETEROMERA, thus serving to indicate that they probably constitute a natural division.

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* Dr. Sharp adopts the term "instar," first proposed by Fischer ('Orthoptera Europæa,' 1853, p. 37) to express the form of insects at their various stages; hitherto there has been no such term in use, entomologists speaking of "the form assumed at the first moult," and so on. If a caterpillar moults five times, the chrysalis becomes the sixth instar and the perfect insect the seventh instar. The adoption of this nomenclature saves considerable inconvenience. The egg does *not* count as an instar, although there seems no reason why it should not be so considered.

The most extraordinary forms are found among certain of the water-beetles (*e. g.* HALIPLIDÆ and GYRINIDÆ) and the DERMESTIDÆ, the larvæ in the former being furnished with long lateral and caudal appendages, and in the latter with a dense clothing of curiously arranged hairs.

The life-history of certain Coleoptera is exceedingly interesting, especially of those forms which undergo what is known as *Hypermetamorphosis*, of which only a very few examples have been adequately investigated. Many larvæ of all orders are provided with special modifications to enable them to adapt themselves to their proper habits of life; but certain insects, with a very complicated life-history, require several further modifications in order to suit their altered circumstances. This is especially the case with those Coleopterous larvæ (*Meloë*, &c.) that are parasitic on certain bees. The best known instance is that of *Sitaris humeralis*, an account of which has been often given, but may perhaps be repeated. The observations were first made by M. Fabre, of Avignon. The eggs are laid by the female near the nest of a bee (*Anthophora*), and from these emerge the first or "triungulin" larvæ, which are very small, hard-skinned, with strong jaws, and long legs and antennæ. According to Fabre they remain motionless and without taking food until the following spring, when they become very active and hook themselves on to the hairs of the male bees, from which they transfer themselves to the females, and from these to the eggs of the bee, which are laid in separate cells filled with honey. After devouring the egg the triungulin assumes

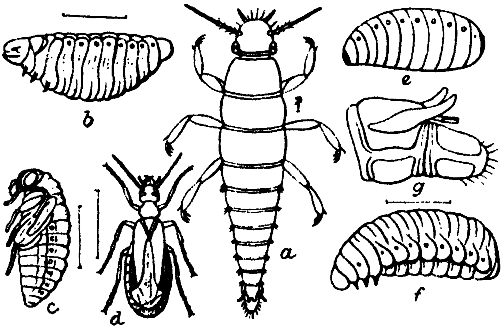

Fig. 18.—Life-history of *Sitaris muralis*. *a*, triungulin or 1st larva : *g*, anal spine erect and claspers of *a* ; *b*, 2nd larva ; *e*, pseudo-pupa ; *f*, 3rd larva ; *c*, true pupa ; *d*, imago. (After Ridley & Packard.)

a second larval form, quite different from the first, dilated beneath and adapted for floating on the honey, which it devours in about six weeks. A few days later this second larva changes into a short and broad pseudo-nymph or pupa, sometimes called the first pupa, in which state the insect passes the winter. In the spring a third larva appears, like the second, but not dilated beneath; this does not eat, and soon changes into an ordinary true Coleopterous pupa, from which emerges the imago. The triungulins of *Meloë* are very differently shaped from those of *Sitaris*, and have the legs more strongly developed, but they are both equally adapted for attaching themselves to bees.

Dr. Sharp also quotes Professor Riley's account of the transformations of a blister-beetle, *Epicauta vittata*, which is parasitic on locusts in North America. The triungulin campodeiform larva is very active, and runs about on the ground in sunny weather, examining the cracks, until an egg-pod of the locust is found; into this it eats its way and begins to devour an egg. After a few days the triungulin changes into a Caraboid larva, and in another week into a form like the larva of a Scarabæid; this grows rapidly, leaves the egg-pod, and in a cavity close by turns into a pseudo-pupa or coarctate larva, quite helpless and inactive, in which form it passes the winter. In spring another Scarabæid-like larva emerges, which is somewhat active, but does not take food; in a few days this changes into a pupa of the ordinary Coleopterous form, from which the perfect insect emerges in the course of five or six days.

The life-histories of several of these insects with various larval forms or instars are more or less known, but they are very hard to work out, and it will be a long time before we possess much detailed knowledge of more than a few of them. In other orders we have perhaps the most interesting case in *Mantispa* (Neuroptera).

Very little is known of the changes that take place in the internal organs of any insects during the various metamorphoses, although in the case of the Diptera the changes are considerable. They do not appear to have been much studied in the Coleoptera, but are probably of much the same character, except that they are not so rapid, as in the Diptera. One thing, however, we have learnt, and that is that "metamorphosis is after all only an extension of embryonic life, the moults and great changes being similar to those undergone by the embryo, and that metamorphosis and alternations of generations are but terms in a single series. Moreover, the metamorphoses of insects are of the same general nature as those of certain worms, of the echinoderms, and the frog, the different stages of larva, pupa, and imago being adaptational and secondary" (Packard). The processes by which the changes take place during metamorphosis are of two kinds: histolysis or breaking down, and histogenesis or building up, of tissue. The intermediary agents in the former, according to Sharp, Miall, and others, are "phagocytes cells similar to the leucocytes or white corpuscles of the blood; the intermediary agents in histogenesis are portions of tissue existing in the larval state incorporated with the different organs, or possessing a connection therewith even when they are to a great degree separated therefrom." Histolysis of the muscular tissue appears to be a sort of inflammatory process, during which the phagocytes attach themselves to, or enter, the tissues which are to be disintegrated, and by which the larval structures are broken down into a creamy substance, the buds or germs from which the new organs are to be developed being exempt from the destruction. These buds grow as they are liberated, and so by the two processes the new creature is formed. This is probably much the same in principle as the ordinary growth of the tissues, only more pronounced and evident through the greater rapidity of the action in these particular transformations (*vide* Sharp, *op. cit.* v, p. 165).

We need not here enter into the interesting question of embryology; those who desire to do so should consult the works of Graber, who has worked out the embryology of a species of *Lina* (CHRYSOMELIDÆ), and others.

Phylogeny.

The earliest known insects belong to the Hemiptera, Orthoptera, and Neuroptera, and to an extinct Neuropterid order Palæodictyoptera; the types are strongly differentiated and they are as well characterized for the most part as any insects now existing; nor are there any transitional forms to bridge over the gap between the Coleoptera and other orders. From the very earliest time of their appearance in geological strata the insects of this order have undergone no appreciable change: the period at which they first appeared is somewhat doubtful, but the evidence tends to prove that none existed during the Palæozoic period, the records being extremely meagre, and the insects described being probably not coleopterous. In the present state of our knowledge we cannot with any certainty say that the order appeared before the Mesozoic period. In the Jurassic period (Lias and Oolite) we find beetles abundant and far more numerous than the insects belonging to any other order; this was the age of the great Saurian reptiles, yet the beetles co-existing with these appear to belong to the same families and genera as those living at the present time. In the Rhætic beds insect remains have been found in such abundance that the beds containing them have been called the "Insect Limestone." The following families, among others, are represented:—SCARABÆIDÆ, CARABIDÆ, GYRINIDÆ, HYDROPHILIDÆ, LATHRIDIIDÆ, BUPRESTIDÆ, ELATERIDÆ, CANTHARIDÆ, CURCULIONIDÆ, and CHRYSOMELIDÆ. The LONGICORNIA, STAPHYLINIDÆ, and COCCINELLIDÆ appear to be altogether absent, as well as the XYLOPHAGA, the deficiency of the latter being noteworthy in the face of the statement made by certain authors that the Coleoptera were originally derived from a wood-boring insect, and that it was this habit that brought about the development of the hard-textured elytra.

As there are absolutely no connecting links of any value, the question of the original ancestor of the order is only a matter of mere hypothesis. Scudder believes that it was a wood-boring *Palæodictyopteron*, while Lameere considers it should be looked for among the Neuroptera-Planipennia, and Ganglbauer would derive the order from the Orthoptera. Lameere (Ann. Soc. Ent. Belgique, xliv, 1900, p. 356) is of opinion that the ancestor of the Coleoptera must have had the following characters:—(1) A complete metamorphosis; (2) four Malpighian tubes; (3) the mouth-parts adapted for trituration of food (*i. e.* mandibulate and not suctorial); (4) the prothorax large and free; (5) five joints to all the tarsi; (6) an onychium between the tarsal claws; (7) three ocelli; (8) eight visible segments of the abdomen; (9) all the coxæ conical and projecting; (10) antennæ with eleven joints, not differentiated.

As mentioned above, this ancestor, according to Lameere's view, must have belonged to the group of Neuroptera-Planipennia, and lived under bark or bored into the trunks of trees, the advantage of the change in the form and substance of the upper wings being therefore evident.

Ganglbauer (Münch. Kol. Zeitschr. i, 1903, p. 276), in alluding to Lameere's hypothesis, says that, while he does not wish to enter upon a discussion as to the phylogenetic origin of the Coleoptera, he is still of opinion that it is more reasonable to consider them as derived from one of the older branches of the Orthoptera.

To this Lameere (Ann. Soc. Ent. Belg. xlvii, 1903, p. 156) replies that if the Coleoptera are considered as descended from the Orthoptera, we admit a "polyphyletisme de l'holometabolisme"; that is to say, that we must allow that holometabolic insects, or insects with perfect or very marked metamorphoses, must have arisen from more than one independent source. Although, at first sight, the argument may seem to have some weight, there really does not appear to be any insuperable objection to the independent origin of the orders or sections in question. But if the objection be sound, we must, to begin with, divide the Neuroptera into two distinct orders. Not that this need cause any difficulty, for the insects placed by Sharp under the Neuroptera are distributed in six different orders by Packard and in five by Brauer.

Since the foregoing paragraphs were written, Herr Handlirsch has published his exhaustive work 'Die Fossilen Insekten.' In vol. ii, p. 1278, t. vii, he shows the SILPHIDÆ and HISTERIDÆ as the earliest beetles. These appeared in the Triassic period, and from the SILPHIDÆ at various periods there spring off the STAPHYLINIDÆ, of which the PSELAPHIDÆ are a later branch, and (in the Cretaceous period) the SCYDMÆNIDÆ, LEPTINIDÆ, CLAMBIDÆ, APHÆNOCEPHALIDÆ *, CORYLOPHIDÆ, TRICHOPTERYGIDÆ, SPHÆRIIDÆ, HYDROSCAPHIDÆ, and SCAPHIDIIDÆ; the PLATYPSYLLIDÆ also probably belong to this period. Somewhat later than the SILPHIDÆ, but still in the Triassic period, come the PALPICORNIA and MALACODERMATA, and a little later (but doubtfully) the CLAVICORNIA (in Ganglbauer's sense, excluding the STAPHYLINOIDEA). In the Triassic period appear the ancestors of the Adephaga, Brachymera, Serricornia, Sternoxia (including BUPRESTIDÆ and ELATERIDÆ), and Teredilia. Later still, in the Middle Jurassic and Lower Oolite ("Dogger"), come the Heteromera, and in the Upper Jurassic and Upper Oolite ("Malm") the Phytophaga, from which, in the Cretaceous period, the Rhynchophora take their origin. Last of all appear the Lamellicornia.

No Coleoptera occur in the Palæozoic period. One hundred and thirty-eight distinct types are found in the Mesozoic period, and about two thousand in the Cainozoic period. The proportion of beetles known in Tertiary and modern times is about 1 to 80; the proportion for the Lamellicorns, however, is only 1 to 180, which appears further to suggest their recent origin.

Referring to the Triassic period (*l. c.* ii, p. 379) Handlirsch says that the Coleoptera are practically impossible to define, and belong to very slightly specialised forms, out of which may be made a Carabid, Dytiscid, Tenebrionid, Chrysomelid, or Rhynchitid; this is shown by the names given to them—*Pseudocurculionites*, *Pseudobuprestides*, *Pseudocarabites*, etc. This is, of course, as Handlirsch incidentally points out (*l. c.* pp. 398–399) partly due to the fact that we have only elytra to deal with, and that it is impossible from these alone to recognize the families with any accuracy.

With regard to the origin of the Coleoptera we cannot agree with Handlirsch's theory that they are derived from primitive forms of *Blatta* or from a branch of the Protoblattoidea. His only arguments in favour of this appear to rest upon outward appearance (the resemblance of the BLATTIDÆ to certain CARABIDÆ, SILPHIDÆ, LAMPYRIDES, etc.), the *Blatta*-like form of certain Silphid larvæ, the large approximate coxæ, and the "egg-laying" of *Hydrophilus*. The extreme difference of the metamorphoses seems to outweigh all these, even though we allow that in a few instances beetles are viviparous.

Handlirsch seems to have more reason in rejecting Lameere's theory that the Coleoptera are derived from wood-boring Neuroptera which have had their upper wings modified into elytra on account of their habits. "Elytra," he says, "are not an adaptation (*Anpassung*) to an *a priori* protected abode (such as a boring in wood), but to a free abode (*Aufenthalt*) on the earth's surface." At the same time this is not entirely convincing.

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* This is apparently meant to include the PSEUDOCORYLOPHIDÆ (of which *Aphænocephalus* is a genus) and PHÆNOCEPHALIDÆ of Matthews (Corylophidæ and Sphæriidæ, 1899, pp. 197, 205).

There can, of course, be no finality on such a question, seeing that so little can possibly be demonstrated regarding it; but if it is of any use to discuss it at all it seems by no means impossible that the ancestor of the Coleoptera is to be found among the SIALIDÆ (Neuroptera-Planipennia) in an extinct group possessing the more complete metamorphoses of the SIALIDES, and with larvæ possessing the terrestrial habits and subcortical habitat of the RAPHIDIIDES. The true position of the Coleoptera, however, with reference to the other orders of insects, is quite uncertain, and they cannot be placed in close proximity with any. We are entirely in the dark as to their phylogeny, and all that has been said regarding it is only more or less unwarrantable hypothesis.

Classification.

In writing a general introduction to the Coleoptera for a work like the present, of which the various sections will be the production of several authors, the question of classification is by far the most difficult to deal with, for, naturally and probably, in the present state of our knowledge, individual authors may refuse to be bound by any system that may be laid down. It should therefore be understood that there is no intention to bind the specialists who may hereafter take part in the work, and in their prefaces and introductions they can, of course, adopt any classification of their groups and families that they think fit.

One thing is certain, and that is that any linear classification is quite out of the question. The attempt to force this has been the chief cause of the confusion that has arisen. The great groups must be regarded as more or less parallel series, arising, hypothetically, from common stocks whose origin is quite unknown, for (so far as we at present know with certainty) they have appeared in geological strata in several instances simultaneously, and their remains, where found, are equally and fully developed.

The earliest writers after Linné, in their systems of classification, laid the chief stress on the variation of the number of joints in the tarsi, Olivier being the first to adopt the primary sections of Pentamera, Heteromera, Tetramera, and Trimera; this division, modified and enlarged by Latreille and others, has been in use up to quite recent times, and must of course be always taken into consideration.

In 1883 Leconte and Horn published their 'Classification of the Coleoptera of North America,' which, although in many points not in accordance with the views of modern Coleopterists, was yet a distinct advance on anything that had preceded it. They divided the order into two primary divisions :—1. COLEOPTERA (GENUINA), having the mouth-parts normal, the palpi always flexible, the gular sutures double, at least before and behind, and the prosternal sutures distinct; and 2. RHYNCHOPHORA, having the head more or less prolonged into a rostrum, the palpi rigid (except in RHINOMACERIDÆ and ANTHRIBIDÆ), the gular sutures confluent along the median line, and the prosternal sutures wanting; there are also exceptions to the last two characters.

The Coleoptera (genuina) were subdivided into two great complexes:—the ISOMERA, having the hind tarsi with the same number of joints as the others, and the HETEROMERA, in which the joints of the hind tarsi were less than those of the anterior pairs; and the Isomera were again divided into the ADEPHAGA, CLAVICORNIA, SERRICORNIA, LAMELLICORNIA, and PHYTOPHAGA. The question of the position of the RHYNCHOPHORA had been dealt with before by the same authors ("The Rhynchophora of America North of Mexico," Proc. Amer. Phil. Soc. xv, 1876), and in this work they are regarded as the lowest, and the LAMELLICORNIA as the highest in rank of all the Coleoptera. This view regarding the position of the RHYNCHOPHORA has not met with acceptance from recent writers, some of whom regard them as an integral portion of the PHYTOPHAGA. Whether this is correct may be open to doubt (they are certainly, on the whole, a highly specialized group), but Kolbe appears to be certainly going too far when, in direct opposition to Leconte and Horn, he speaks of them as one of the most highly developed types of Coleoptera, and a type that is most widely separated from the lowest forms (Zeitsch. für Ent. 1903, p. 144).

In 1899 Dr. Sharp, in the 'Cambridge Natural History' (vol. vi, Insecta, part ii, p. 190), published the following classification of the Coleoptera:—

Series 1. LAMELLICORNIA.—Antennæ with the terminal joints leaf-like (or broader than the others, if not actually leaf-like), and capable of separation and of accurate apposition. Tarsi five-jointed.

Families. Passalidæ, Lucanidæ, Scarabæidæ.

Series 2. ADEPHAGA (CARABOIDEA of some authors).—Antennæ never lamelliform, thin at the end; all the tarsi five-jointed, with the fourth joint quite distinct. Maxillæ highly developed, with the outer lobe slender and divided into two segments so as to be palpiform. Abdomen with six (or more) ventral segments visible.

Families. Cicindelidæ, Carabidæ, Amphizoidæ, Pelobiidæ, Haliplidæ, and Dytiscidæ.

Series 3. POLYMORPHA.—Antennæ frequently with either a club, *i. e.* the distal joints broader (Clavicorn series of authors), or the joints from the third onwards more or less saw-like, the serrations being on the inner face (Serricorn series of authors); but these, and all the other characters, including the number of joints in the tarsi, very variable.

Families. Paussidæ, Gyrinidæ, Hydrophilidæ, Platypsyllidæ, Leptinidæ, Silphidæ, Scydmænidæ, Gnostidæ (containing two Brazilian ants'-nest species), Pselaphidæ, Staphylinidæ, Sphæriidæ, Trichopterygidæ, Hydroscaphidæ, Corylophidæ, Scaphidiidæ, Synteliidæ, Histeridæ, Phalacridæ, Nitidulidæ, Trogositidæ, Colydiidæ, Rhysodidæ, Cucujidæ, Cryptophagidæ, Helotidæ, Thorictidæ, Erotylidæ, Mycetophagidæ, Coccinellidæ, Endomychidæ, Mycetæidæ, Lathridiidæ, Adimeridæ (containing one American genus), Dermestidæ, Byrrhidæ, Cyathoceridæ (containing one species from Central America), Georyssidæ, Heteroceridæ, Parnidæ, Derodontidæ, Cioidæ, Sphindidæ, Bostrychidæ, Ptinidæ, Malacodermidæ, Melyridæ (or Malachiidæ), Cleridæ, Lymexylonidæ, Dascillidæ, Rhipiceridæ, Elateridæ, Buprestidæ.

Series 4. HETEROMERA.—Front and middle tarsi five-jointed, hind tarsi four-jointed. Other characters very variable.

Families. Tenebrionidæ, Cistelidæ, Lagriidæ, Othniidæ (a very doubtful family), Ægialitidæ, Monommidæ, Nilionidæ. Melandryidæ, Pythidæ, Pyrochroidæ, Anthicidæ, Œdemeridæ, Mordellidæ (including Rhipidophoridæ), Cantharidæ (or Meloidæ), Trictenotomidæ.

Series 5. PHYTOPHAGA.—Tarsi four-jointed (apparently), but with a small additional joint at the base of the fourth joint; sole usually densely pubescent (sometimes the tarsi are bare beneath or bristly, and occasionally the small joint at the base of the fourth is more distinct).

Families. Bruchidæ, Chrysomelidæ (containing four subfamilies, Eupoda, Camptosomes, Cyclica, Cryptosomes), Cerambycidæ (containing three subfamilies, Prionides, Cerambycides, Lamiides).

Series 6. RHYNCHOPHORA.—Head prolonged in front to form a beak; gula indistinguishable. (Palpi usually not evident.) Tarsi four-jointed (apparently), but with a very minute additional joint at the extreme base of the fourth joint.

Families. Anthribidæ, Curculionidæ, Scolytidæ, Brenthidæ.

Two families are considered by Sharp to be of uncertain position, the AGLYCYDERIDÆ (from the Canary Islands, New Zealand, and New Caledonia) and the PROTERRHINIDÆ (from the Hawaiian Islands exclusively); they may be aberrant Rhynchophora, but this is very doubtful.

The weak point in this classification is the series POLYMORPHA, which is unwieldy and of necessity loosely defined, for it is only formed to include all the elements (mostly discordant) which cannot be placed under any other division. It seems, however, impossible, in the present state of our knowledge, to avoid these large heterogeneous groups, and the objection applies with as much or even more force to the HETERORRHABDA of Kolbe or the POLYPHAGA of Ganglbauer, which embraces a considerably wider scope than the POLYMORPHA as used by Sharp. If one of these comprehensive terms must be employed, and it seems impossible, for convenience' sake, to do without them, it seems best to adopt the name "Polycerata" as including the old divisions CLAVICORNIA, SERRICORNIA, etc. For all practical purposes, however, the groups might as well be distinguished by letters or figures. Ganglbauer's term has certainly the advantage of answering to the term ADEPHAGA, but, on the other hand, it includes the LAMELLICORNIA.

Apart from the division POLYMORPHA Sharp's arrangement differs but little from the system of Leconte and Horn, except that the latter include the STYLOPIDÆ under the HETEROMERA, whereas

Sharp places them at the end of the Coleoptera under STREPSIPTERA, and does not state definitely whether they are to be united to the Coleoptera or regarded as a separate order.

Although it is only comparatively recently that the venation of the wings of Coleoptera has been seriously used for systematic classification, yet it must not be forgotten that Burmeister (Mag. Zool. 1841, no. 76, pp. 14, 15) included on this character the CARABIDÆ, PAUSSIDÆ, DYTISCIDÆ, and GYRINIDÆ in his group CARNIVORA or ADEPHAGA. Extensive work has been done in other orders by Hagen, Scudder, Brauer, and others, who recognized the phylogenetic importance of the wing venation, but the Coleoptera have certainly not had their share of attention in this respect. As, however, the character is now much more systematically employed, it is necessary that something should be said about it before we proceed further.

There is very great difference in the wing venation in the various families, but, in spite of all variations, there appear to be three principal types, on which may be founded three divisions of the order, and it is requisite that their characteristics should be explained, although it must be allowed that they break down in some cases and cannot always be depended upon.

There has been considerable divergence in the names applied to the various veins by different authors, with the result that much confusion has arisen, and it is highly desirable that a uniform system should be adopted. We have here adopted the nomenclature of Comstock, Needham, Ganglbauer, and others, and regard the veins as arranged as follows:—Costal (*c.*), Subcostal (*sc.*), Radial (*r.*) 1 and 2, Median (*m.*) 1 and 2, Cubital (*cu.*) 1 and 2, Anal (*a.*) 1, 2, 3 and 4.

The characteristics of the three groups before alluded to, as adopted by Ganglbauer and others, are as follows:—

1. *Adephagid type* (fig. 19).—This is chiefly distinguished by the presence of one or two transverse veins joining the two median veins (*Omma*), or by two transverse veins situated nearer to the base and joining the upper median or an irregular branch of the lower radial vein to the lower median, thus forming a usually very definite enclosed space, called the *areola oblonga* or the *oblongum* (*o*). The latter is very characteristic of the greater number of the ADEPHAGA, but in *Cicindela* and *Rhysodes* only the single transverse vein is present. In this group the branches of the radial vein enclose or tend to enclose an irregular space just behind the costa, at about the middle or nearer to the apex.

2. *Staphylinid type* (fig. 20).—The chief characters of this group are found in the absence of transverse veins; there are, therefore, no enclosed spaces on the wing. The veins, moreover, are much more simple, and the first or exterior median vein does not extend right across the disc and is not joined

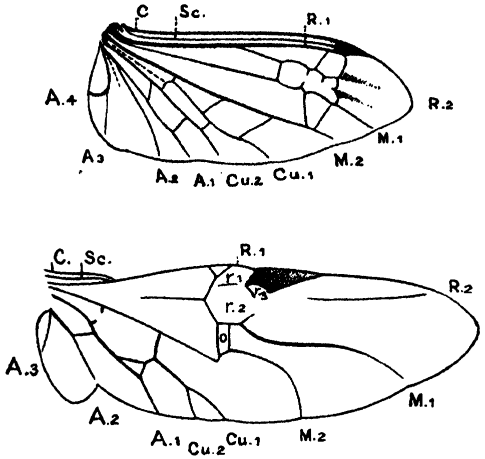

Fig. 19.—Adephagid type of wing.
Upper figure: *Omma stanleyi.* (After Kolbe.)
Lower figure: *Tachypus flavipes.* (After Kempers.)

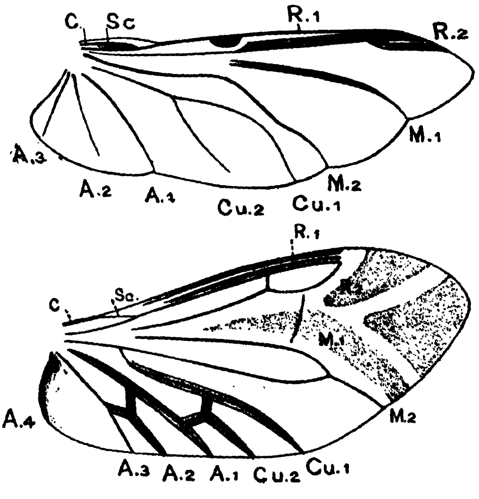

Fig. 20.

Upper figure: Staphylinid type of wing; *Necrophorus vespilloides.*
Lower figure: Cantharid or Telephorid type of wing; *Lygistopterus sanguineus.* (After Kempers.)

at the base to any other vein. This is a very distinct and uniform type, as far as it goes, but its adoption seems to have the effect of keeping apart several genera that on other characters appear to be somewhat closely allied; this kind of difficulty, however, is liable to arise in every system of classification.

3. *Cantharid* or *Telephorid type* (fig. 20).—The chief characteristic of this division is the loop formed at some distance from the apex of the wings by the coalescence of the two median veins, one alone (it is usually hard to say which) being continued to the margin from the centre of the loop. A somewhat similar loop is found in the typical species at the apex of the radial veins, and transverse veins occur joining the cubital and anal veins; in all these forms, however, there is great variation, and the type, as a whole, undergoes so much modification, and sometimes breaks down so entirely that its value becomes very doubtful. The characteristic median loop is very small in some families, and is often reduced to a mere hook at the apex (as in *Tegrodera erosa*, one of the MELOIDÆ); it is very plain in many Lamellicorns, but practically absent in *Geotrupes*, and this is also the case with the PASSALIDÆ and many RHYNCHOPHORA. Many of these latter, with their quite simple venation and the absence of any transverse veins, might well be classed under the Staphylinid type. This variation largely discounts the value of the whole characters of the wing venation as affording a reliable ground for classification; at the same time it is a very great help if taken in conjunction with other characters.

A beetle may be compared to an aeroplane, being considerably heavier than air, with the elytra and wings constituting the balancing-frame, the body representing the passengers and material, and the wing-muscles representing the motor. In order to counteract the comparatively great weight of the body the wings must present a correspondingly large area, and must, therefore, when expanded, be much larger than the elytra. As it is, however, of the greatest importance to the insect that the delicate wings should be protected by the elytra, there must necessarily be a mechanism for folding them, and this we find to be the case not only in the Coleoptera, but in all orders that have the outer wings corneous or coriaceous; the arrangement is especially simple and beautiful in the case of the FORFICULIDÆ and BLATTIDÆ, in which the wings open and shut like a fan. This is also seen in the PHASMIDÆ. In the Coleoptera the method of folding is both longitudinal and vertical; in many cases the apical and anal portions are singly or doubly folded back upon the rest of the wing, but in other cases, especially, as might be expected, in the brachelytrous species, the arrangement is much more complicated. We have received a valuable paper from Mr. Woolworth, published by him in the 'University of Canada Publications' (Technical

Bulletins, Entomology, vol. i, no. 1, pp. 1-152), in which he deals with the flight and venation of insects; in it he has paid special attention to the lines of folding, which are almost as interesting as the veins themselves, and by his kind permission we are enabled to give figures of the methods of folding in the case of three types of wings. "The most characteristic thing," he says (*l. c.* p. 126), "about the hind wing in this order is the manner of folding. These wings exhibit a good deal of variation in this respect, but there is one point in which they all agree, if the wing folds transversely at all —abortive wings, or those not fully covered by the elytra, lose the characteristic fold that occurs in all normal wings. This common character is the dividing of the area between the two strong divergent veins [called by him the primary and first posterior] into four triangular areas by the lines of folding [the triangles are seen in the figure]. Besides these there is always one and sometimes two basal folds, and there are also extremely variable apical folds. The method of folding is as follows: the largest white area, the third coming from the margin near the base, is the only one that remains uncovered. All the adjacent areas bend under it. The tip of the wing beyond the triangles folds first longitudinally along a slight curve, which causes the extreme tip to fold back upon the more basal portion. The folding is brought about in the first type of wing [fig. 21] by the approximation of the tips of the primary and first posterior (radial and median) veins by their own elasticity, and the extension of the wing by a pull on the anterior marginal (costal and subcostal) veins by the anterior muscles. The folding

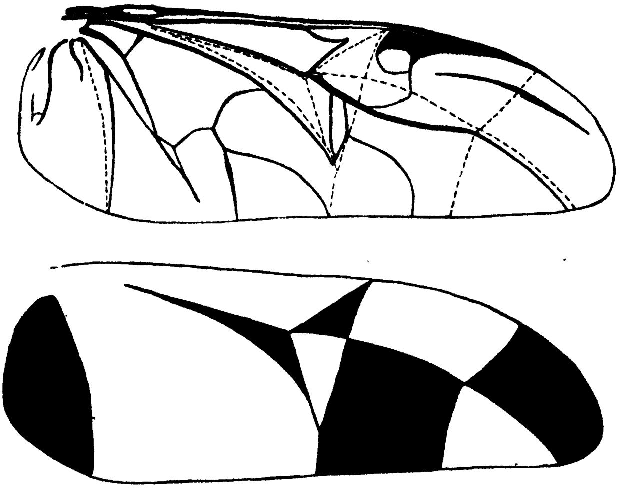

Fig. 21.—Venation and folding of wings of *Harpalus caliginosus*; Adephagid type. Dotted lines indicate lines of folding; black areas those that are reversed in folding. (After Woolworth.)

in the second type is much the same except that there is a single and not a double folding of the apical region." In the Staphylinid type, as we have said before, the arrangement is much more elaborate; in this case there are three transverse folds and several

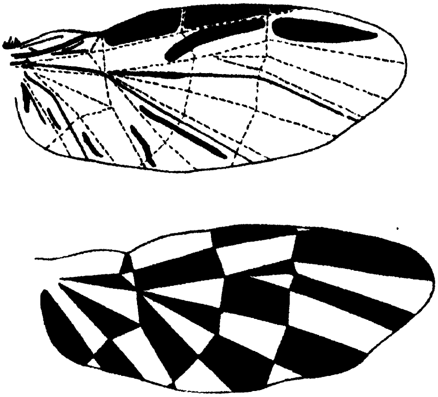

Fig. 22.—Venation and folding of wings in *Staphylinus cinnamopterus*; Staphylinid type. Dotted lines and black areas indicate same as in fig. 21. (After Woolworth.)

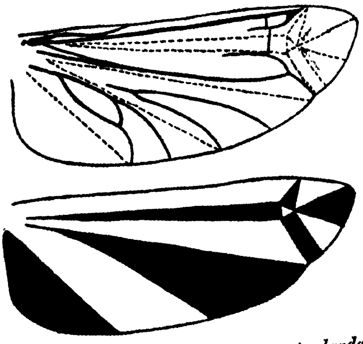

Fig. 23.—Venation and folding of wings in *Dermestes lardarius*; Cantharid or Telephorid type. Dotted lines and black areas indicate same as fig. 21. (After Woolworth.)

added longitudinal folds in the apical region of the wing. A peculiar feature of the groups is the carrying of the basal transverse fold across the anal region. The wings of the STAPHYLINIDÆ will be found further alluded to in the account of the family.

Lameere, in his classification (Ann. Soc. Ent. Belg. xliv, 1900, p. 357), makes use of these distinctions and divides the Coleoptera into three suborders: CANTHARIDIFORMIA, STAPHYLINIFORMIA, and CARABIFORMIA.

I. The CANTHARIDIFORMIA include the following:—

1. TEREDILIA, with the families Lymexylonidæ ("la famille qui est la plus voisine du Néuroptère ancestral"), Anobiidæ (Anobiinæ, Ptininæ), Bostrychidæ (Lyctinæ, Bostrychinæ), Cupedidæ, and Derodontidæ.
2. MALACODERMATA, with the families Cantharididæ or Telephoridæ (including Cantharidinæ or Telephorinæ, Lycinæ, Lampyrinæ, Drilinæ) and Melyridæ (Malachiinæ, Melyrinæ, Corynetinæ, Clerinæ).
3. STERNOXI, with the families Dascillidæ (Dascillinæ, Chelonariinæ, Eucinetinæ, and Cyphoninæ; the latter two are referred to the Dascillidæ with some doubt), Elateridæ (Cebrioninæ, Perothopinæ, Eucneminæ, Cerophytinæ, Soleniscinæ, Elaterinæ, Throscinæ), and Buprestidæ.
4. MACRODACTYLES, with the family Parnidæ (Psepheninæ, Parninæ, Elmidinæ, and Heterocerinæ).
5. BRACHYMERA, with the families Dermestidæ and Byrrhidæ; in the latter family *Nosodendron* is included, although very doubtfully, as Lameere says that it has nothing in common with the Byrrhidæ except the retractability of the legs.
6. PALPICORNIA, with the family Hydrophilidæ (Helophorinæ, Hydrophilinæ).
7. CLAVICORNIA, with the families Nitidulidæ (Hypocephalinæ, Sphæritinæ, Synteliinæ, Trogositinæ, Nitidulinæ, Byturinæ), Mycetophagidæ, Cissidæ (Cissinæ, Sphindinæ), Erotylidæ (Erotylinæ, Cryptophaginæ), Phalacridæ, Colydiidæ, Lathridiidæ, Endomychidæ (Mycetæinæ, Endomychinæ), Coccinellidæ, Cucujidæ (Cucujinæ, Helotinæ), Brenthidæ.
8. PHYTOPHAGA, with the families Cerambycidæ, Chrysomelidæ, Bruchidæ (Bruchinæ, Anthribinæ), Curculionidæ.
9. HETEROMERA, with the families Tenebrionidæ, Melandryidæ (Melandryinæ, Mordellinæ, Rhipiphorinæ, Stylopinæ), and Lagriidæ (Lagriinæ, Pythinæ, Pyrochroinæ, Meloinæ, Œdemerinæ, and Anthicinæ).
10. LAMELLICORNIA, with the families Lucanidæ (Lucaninæ, Troginæ) and Scarabæidæ (Scarabæinæ, Melolonthinæ, Dynastinæ).

II. The STAPHYLINIFORMIA include the families Silphidæ (Silphinæ, Clambinæ, Sphæriinæ, Hydroscaphinæ, Scaphidiinæ, Corylophinæ, Trichopteryginæ, Scydmæninæ), Histeridæ, Staphylinidæ, Pselaphidæ, Platypsyllidæ, and Pulicidæ (Fleas).

III. The CARABIFORMIA include the families Rhysodidæ, Carabidæ, Paussidæ, Dytiscidæ (Omophroninæ, Haliplinæ, Amphizoinæ, Hygrobiinæ, Hydroporinæ, Dytiscinæ).

There is a great deal that is good in this classification, but the chief objections appear to be against the following points:—The removal of the BRENTHIDÆ from the RHYNCHOPHORA to the Clavicorns; the inclusion of the PULICIDÆ or Fleas among the Coleoptera; the position of *Hypocephalus* among the NITIDULIDÆ, and (though less to be objected to) of *Omophron* among the DYTISCIDÆ. The AMPHIZOINÆ, moreover, are not DYTISCIDÆ, and should be considered a separate family. Several of these points are defended by M. Lameere (Ann. Soc. Ent. Belg. xlvii, 1903, p. 155), but we cannot agree with him in the present state of our knowledge, nor can we always quite follow his phylogeny. At the end of the second paper he gives the following table:—

- COLEOPTERA
  - Adephaga
    - Cupediformia.
    - Carabiformia.
  - Polyphaga
    - Cantharidiformia
      - Teredilia.
      - Malacodermata.
      - Sternoxia.
      - Macrodactylia.
      - Brachymera.
      - Palpicornia.
      - Clavicornia.
      - Phytophaga.
      - Heteromera.
      - Lamellicornia.
    - Staphyliniformia.

On the face of it it seems quite inadmissible to apply the term "Cantharidiformia" to Malacoderms, Elateridæ, Clavicorns, Lamellicorns, Rhynchophora, etc., indiscriminately.

Kolbe in 1901 published a system of classification (Archiv für Naturg., Jahrg. Beiheft, Festschrift für Eduard von Martens, pp. 89–150, Taf. ii & iii), which he afterwards modified in a paper "Zur Systematik der Coleopteren" (Allg. Zeitsch. Entom. 1903, pp. 137–145). In the latter article he divides the Coleoptera into two suborders, Adephaga and Heterophaga.

The Adephaga fall into two divisions, Protadephaga and True Adephaga. These are distinguished by the formation of the ventral segments and the venation of the wings. To the former division belong the Cupedidæ alone; to the latter the Cicindelidæ, Carabidæ, Amphizoidæ, Pelobiidæ, Haliplidæ, Dytiscidæ, Gyrinidæ, Paussidæ, and Rhysodidæ.

The Heterophaga also are placed under two divisions, Haplostomata and Rhynchophora.

The Haplostomata are again subdivided into four groups; of these the first three, Staphylinoidea, Actinorrhabda, Heterorrhabda, are characterized by having the penultimate joint of the tarsi equal or nearly equal to the preceding, and may be classed together as Homœopoda.

The Staphylinoidea contain the following families:—Staphylinidæ, Silphidæ, Scydmænidæ and Pselaphidæ, Catopidæ, Hypocephalidæ, Anisotomidæ, Corylophidæ, Trichopterygidæ, Hydroscaphidæ, Scaphidiidæ, Clambidæ, Sphæriidæ, Leptinidæ, Platypsyllidæ, and Histeridæ.

The Actinorrhabda contain the Synteliidæ, Lucanidæ, and Scarabæidæ, but not the Passalidæ.

The Heterorrhabda answer very closely to the Polymorpha of Sharp, and are open to the same objections, only more so, as they contain the HETEROMERA as well as the greater part of the Clavicorn series, the Malacoderms, the ELATERIDÆ, and BUPRESTIDÆ, etc. Kolbe also includes the PASSALIDÆ, which appears to be contrary to all accepted views.

The ANCHISTOPODA are characterized by Kolbe as having the penultimate joint of the tarsi very small and more or less hidden between the lobes of the third joint; they include the Phalacridæ, Cryptophagidæ, Erotylidæ, Prionidæ, Cerambycidæ, Bruchidæ, Chrysomelidæ, Endomychidæ, and Coccinellidæ.

The second great division of the HETEROPHAGA is formed by the RHYNCHOPHORA, including the families Rhinomaceridæ, Anthribidæ, Oxycorynidæ, Rhynchitidæ, Apionidæ, Brachyceridæ, Proterhinidæ, Brenthidæ, Platypidæ, Tomicidæ, and Curculionidæ. While Leconte and Horn regard the Rhynchophora as the lowest representatives of the Coleoptera, Kolbe places them at the head of the order and assigns them the highest place. Kolbe has since modified, expanded, and altered several of his views in a series of articles in the 'Zeitscrift für wissenschaftliche Insekten Biologie,' Band iv, 1908, pp. 116, 153, 219, 246, 286, 389, which are perhaps the best that he has written on the subject.

Although there is much that is good in his classification, yet in the present state of our knowledge it is not likely to be adopted, and we may pass on to the arrangement of Ganglbauer, which appears to be the best that has yet been put forward. It will be found fully explained in his interesting and exhaustive pamphlet published in the 'Münchener Koleopterologische Zeitschrift' (1903, pp. 271–319), for a copy of which I am much indebted to the author, as well as for the use I have made of his work.

According to Ganglbauer there are two suborders of Coleoptera, ADEPHAGA and POLYPHAGA; these are distinguished by him as follows:—

I. ADEPHAGA.—Venation of wings of the Adephagid type (p. 40); ovaries with nutriment-chambers inserted between the egg-chambers (meroistic); testes simple, tubular; one pair of accessory glands present in the male genital organs; four Malpighian tubes; larvæ more or less campodeiform, with two-jointed tarsi; habits, as a rule, active, predaceous, and carnivorous; to this may be added the fact that the antennæ are filiform, often setaceous, rarely moniliform or irregular.

II. POLYPHAGA.—Venation of the wings of the Staphylinid or Cantharid type (p. 42); ovaries with a single nutriment-chamber at one end (holoistic); testes follicular; one or more pairs of accessory glands present in the male genital organs; four or six Malpighian tubes; larvæ very variable; habits widely differing.

We propose to adopt these two suborders, but to separate the LAMELLICORNIA from the second and place them in a third suborder at the head of the Coleoptera. They are the most homogeneous group, and appear to be distinct by reason of the characteristic lamellate antennæ, the strongly developed sexual dimorphism of the head, and the distinct and, as a rule, uniform structure of the larvæ. The habits, moreover, of some of the species appears to show a higher grade of intelligence. They may be defined as follows:—

III. LAMELLICORNIA.—Venation of wings chiefly Cantharid; antennal club lamellate throughout the subfamilies; ganglia more or less concentrated (except in the LUCANIDÆ); ovaries holoistic; testes follicular, with the follicles rounded and stalked; one pair of accessory glands in the male genital organs (except very rarely, as in *Cetonia*, where there are three pairs); four Malpighian tubes; larvæ usually without ocelli, stout thick grubs, with the body more or less curved, so that their usual position is to lie sideways; larval legs comparatively long, the hind pair rudimentary in the PASSALIDÆ; many of the larvæ with powers of stridulation; sexual dimorphism strongly marked in several groups.

The second division (POLYPHAGA) requires subdivision; the divisions adopted by Ganglbauer are the STAPHYLINOIDEA, DIVERSICORNIA, HETEROMERA, PHYTOPHAGA, and RHYNCHOPHORA. The STAPHYLINOIDEA form a fairly homogeneous group, and the wing-venation is of much service in defining it, but the DIVERSICORNIA are very heterogeneous; there is hardly a single character in Ganglbauer's definition that is not extremely variable in the different families comprised under it, and it is, of course, a well-known fact that the real difficulty of a classification of the order rests with the large series of heterogeneous forms which are found in this section. As, however, Dr. Sharp has remarked, a large number of these forms belong to families that are easily recognized, and it is therefore best, for the present at any rate, to adopt the old artificial divisions.

The classification here adopted will then run as follows:—

Suborder I. ADEPHAGA.
Suborder II. POLYCERATA (Polymorpha or Polyphaga).
  Division 1. Staphylinoidea.
  „ 2. Clavicornia.
  „ 3. Serricornia (provisionally including Malacodermata).
  „ 4. Heteromera.
  „ 5. Phytophaga (including Longicornia).
  „ 6. Rhynchophora.
Suborder III. LAMELLICORNIA.

This is a combination of the systems of Ganglbauer and Sharp; it must be remembered that the divisions under Suborder II. are for the most part parallel and are not arranged in linear succession.

Sub-Order I. *ADEPHAGA.*

The ADEPHAGA have by most authors been placed at the head of the Coleoptera by reason, in great measure, of their predatory habits, as answering to the beasts of prey and the rapacious birds. By recent writers, however, they are placed at the lower end of the order, as the most primitive series, the reasons alleged being the visibility of the second ventral segment of the abdomen*, the simple antennæ, the tubular testes, the more complicated structure of the wings, and the campodeiform larvæ. Several of these characters are found in other groups, but in the ADEPHAGA there is a combination of a large number of characters which are believed to point to a primitive origin. At the same time we know very little for certain with regard to the significance of these characters from a phylogenetic point of view, and what we do know is perpetually being modified and corrected by fresh discoveries. As a matter of fact comparatively few species (indeed an infinitesimally small number, compared with the probable total) have been examined in each group and generalisations may be easily upset.

The chief characteristics of the ADEPHAGA have been mentioned above: the venation of the wings is very distinct and important, the areola oblonga, formed by the two cross veins joining the median veins, being very characteristic. In the CICINDELIDÆ it is usually wanting, although it is found in *Pogonostoma*, but there are other good characters which may distinguish the venation.

The number of the Malpighian tubes is four (these are usually four or six), and this would appear to be the primitive number; some authors, however, believe that six is the primitive number and derive the four from the six. Lameere, if consistent with his general argument, should uphold the latter, as in his classification he almost invariably derives the less from the more. In *Cyphon* (including *Helodes*) considerable difficulty appears to have been caused by the fact that there are four Malpighian tubes in the larvæ and six in the imago, but if four is the primitive number the difficulty vanishes. Many more beetles will probably be found to show the same arrangement in their larval and perfect states. The filiform antennæ (very rarely irregular or moniliform) and the active campodeiform larvæ are also characteristic of the ADEPHAGA.

The families which have been usually assigned to the group are the CICINDELIDÆ, CARABIDÆ, HALIPLIDÆ, DYTISCIDÆ, HYGROBIIDÆ

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* In the great majority of Coleoptera, the first visible ventral plate is the lower sclerite of the third abdominal segment.

(or PELOBIIDÆ), GYRINIDÆ, and in more recent years the comparatively newly discovered AMPHIZOIDÆ. To these have been added the CUPEDIDÆ, RHYSODIDÆ, and PAUSSIDÆ, in great measure on account of the venation of the wings. Sharp, as will be seen above, excludes from the series the three last mentioned families and also the GYRINIDÆ, although he says that the PAUSSIDÆ and RHYSODIDÆ will probably have to be included.*

With regard to the GYRINIDÆ, Sharp writes as follows (Cambridge Natural History, vi, p. 216):—"The GYRINIDÆ are one of the most distinct of all the families of Coleoptera: by some they are associated with the Adephagous series; but they have little or no affinity with the other members thereof. Without them the ADEPHAGA form a natural series of evidently allied families, and we consider it a mistake to force the GYRINIDÆ therein because an objection is felt by many taxonomists to the maintenance of isolated families. Surely if there are in nature some families allied and others isolated, it is better for us to recognise the fact, though it makes our classifications look less neat and precise, and increases the difficulty of constructing tables." These remarks may well be commended to the notice of systematists in cases in which families have been ruthlessly crammed into abnormal positions for the sake of uniformity. At the same time, the wings of the GYRINIDÆ are distinctly adephagid in their venation, and unless they are raised into a sub-order having equivalent value with the ADEPHAGA, it is best to retain them in their present position. I have already pointed out (Coleoptera of the British Islands, i, pp. 209–211) 'that the GYRINIDÆ, if separated from the ADEPHAGA, must be regarded as finding in them their nearest allies, and have discussed at some length their peculiarities and affinities. I did not, however, take the wing venation into account, as very little attention had then been paid to this point, so far as the Coleoptera were concerned. In some points they approach nearer to the HYDROPHILIDÆ than to the ADEPHAGA.

In the arrangement here adopted the CICINDELIDÆ, CARABIDÆ, HALIPLIDÆ, DYTISCIDÆ, HYGROBIIDÆ, AMPHIZOIDÆ, PAUSSIDÆ and RHYSODIDÆ are regarded as ADEPHAGA proper: the GYRINIDÆ as doubtful, but as probably a separate offshoot from the stem of the series: and the CUPEDIDÆ as outside this and all other series, but as best placed near the ADEPHAGA in the present state of our knowledge.

If for the sake of showing things more clearly we may, for the moment, adopt the term "Protadephaga," used by Ganglbauer and others, we might represent the group as follows:—

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* Dr. Sharp has since come to the conclusion that the RHYSODIDÆ are purely Carabid and that *Cupes* is very extraordinary and quite isolated.

Protadephaga.

Cupedidæ.

Gyrinidæ.

Cicindelidæ.
Carabidæ.
Haliplidæ.
Dytiscidæ.
Hygrobiidæ.
Amphizoidæ.
Paussidæ.
Rhysodidæ.

The following table will serve to distinguish the families of the ADEPHAGA, as here constituted. In all succeeding tables the only families dealt with are those of which members have been known to occur in the Indian region; we have, however, included in the present one all the known families, as the connecting links are very interesting, and, moreover, two families out of the three which have not yet occurred in India (AMPHIZOIDÆ and HYGROBIIDÆ (PELOBIIDÆ)) are represented in Tibet.

I. Abdomen with six or seven (rarely eight) visible ventral segments, the first three connate but with the sutures apparent.
  i. Metasternum with a transverse suture before the posterior coxæ.
    1. Transverse suture before posterior coxæ extending across the metasternum, which is continued behind in a triangular process between the coxæ.
      A. Posterior coxæ normal; antennæ 11-jointed.
        a. Clypeus extending on each side beyond the base of the antennæ .. **Cicindelidæ**, p. 52.
        b. Clypeus not extending on each side beyond the base of the antennæ .. **Carabidæ**, p. 54.
      B. Posterior coxæ extended into two broad plates covering the first three segments of the abdomen; antennæ 10-jointed .... [**Haliplidæ**], p. 61.
    2. Transverse suture of metasternum very short, only reaching across the central portion; metasternum not prolonged between the posterior coxæ.
      A. Anterior coxæ conical: tibiæ and tarsi with swimming hairs .... [**Hygrobiidæ**], p. 60.
      B. Anterior coxæ globular; tibiæ and tarsi without swimming hairs ...... [**Amphizoidæ**], p. 59.
  ii. Metasternum without a transverse suture before the posterior coxæ.
    1. Posterior coxæ contiguous on their inner margin: metasternum slightly produced between them; legs natatorial.
      Eyes not divided; antennæ normal .. **Dytiscidæ**, p. 62.

Eyes completely divided; antennæ abnormal, very short .... **Gyrinidæ**, p. 65.

2. Posterior coxæ very widely separated; metasternum emarginate before them, very large, almost as long as the abdomen; antennæ moniliform; legs ambulatorial .... **Rhysodidæ**, p. 68.

II. Abdomen with four visible ventral segments (the basal segments being connate without apparent suture); antennæ with 2–11 joints *, usually more or less abnormal; metasternum with an antecoxal suture extending almost across its breadth, slightly produced between the posterior coxæ .... **Paussidæ**, p. 67.

III. Abdomen with five free ventral segments; antennæ 11-jointed; metasternum with a deep antecoxal suture, extending almost across its breadth, scarcely produced between the posterior coxæ .... **Cupedidæ**, p. 68.

Family 1. CICINDELIDÆ.

Clypeus extending laterally in front of the insertion of the antennæ; head large; eyes large and prominent; antennæ eleven-jointed, inserted on the forehead above the base of the mandibles, with the joints, except the four basal ones, finely pubescent; maxillæ with the outer lobe two-jointed (sometimes rudimentary and setiform (Therates)), *the inner lobe (or lacinia) nearly always terminated by an articulated hook (except in* CTENOSTOMIDÆ); *abdomen with the three anterior segments connate, with six ventral segments visible in the female, and seven, as a rule, in the male; legs slender, formed for swift running; posterior coxæ dilated internally, not reaching the sides of the body; venation of wings irregular, the areola oblonga nearly always wanting.*

As the CICINDELIDÆ are described in the present volume there is no need to say much about them. From the ferocity of their nature (as well, perhaps, as from their colouring), they are often called "Tiger Beetles," a name which they well deserve. Their larvæ, moreover, are more ferocious than the perfect insects; but comparatively few have been discovered, and nothing is known of the life-history of some important genera (e. g. *Tricondyla* and *Therates*); quite recently a larva of the genus *Collyris* has been described by Mr. Shelford, a full account of which will be found in the following pages.

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* Ganglbauer (Die Käfer Mitteleuropa. i, p. 3) says 2–6 or 10 joints, but the comparatively recently described genus *Protopaussus* has the antennæ normal and 11-jointed.

Most of the CICINDELIDÆ have long legs, but in some cases these are abnormally long and slender, and as most of these long-legged species are also very quick on the wing, they are exceedingly difficult to capture. The largest members of the family belong to the African genus *Mantichora*; these are entirely black or brown and have no wings, as is the case with several other small genera (*Ctenostoma*, etc.); when pursued they open their enormous mandibles and adopt a "scare attitude" after the fashion of *Ocypus olens* (STAPHYLINIDÆ). Dr. Sharp states that Péringuey found a breeding ground of *M. tuberculata*, de G., near Kimberley; the larvæ were living in the usual Cicindelid manner; but the ground was so hard that he was not able to investigate the burrows and there were but few insects that could serve as food in the neighbourhood. The genus *Pogonostoma*, containing about thirty species, is peculiar to Madagascar and is remarkable for the great development of the palpi; the species are arboreal in their habits.

Dr. W. Horn, the great authority on the family, divides it into eight subfamilies :—CTENOSTOMINÆ, COLLYRINÆ (including *Collyris* and *Tricondyla*), THERATINÆ, CICINDELINÆ, MEGACEPHALINÆ, NEOMANTICHORINÆ, PALÆOMANTICHORINÆ, and PLATYCHILINÆ (the latter including only one genus and one species from South Africa).

Westwood (Modern Classification of Insects, i, p. 52, 1839) says that "the number of insects belonging to this family scarcely exceeds 250"; at present some 1500 species are known and they are perpetually being added to. Some recent writers on classification apparently desire to include the CICINDELIDÆ under the CARABIDÆ; but the two families appear to be distinct by reason of their general facies, the formation of the head, the absence of the *areola oblonga* on the wings, and their development and life-history; it is probable too that they differ in other points which have not been much noticed. At all events Packard (Text-Book of Entomology, p. 254), in speaking of the sensory organs of beetles says that "in the CICINDELIDÆ the epipharynx bears a sensory field quite different from that of the CARABIDÆ. There are no normal taste-cups, except a few situated on two large, round, raised areas which are guarded in front by a few very long setæ. On the surface of each area are numerous very long setæ, which may, if not tactile, have some other sense, as they arise from cup-like bases or cells. Those on the outside are like true taste-cups, with a bristle but little longer than normal in taste-cups generally." This sensory field Packard is disposed to regard as a highly specialized gustatory apparatus; probably it has to do with other senses as well, but at all events it appears to afford characters absent in the CARABIDÆ. Packard does not it is true say whether it is universal in the CICINDELIDÆ, and it would hardly appear likely that all the genera have been investigated for these characters.

Family 2. CARABIDÆ.

Head usually, but not always, narrower than the prothorax; clypeus not extending laterally in front of the insertion of the antennæ; antennæ eleven-jointed; maxillæ without an articulated hook at the apex of the inner lobe (or lacinia), outer lobe almost always with two joints; abdomen with the three anterior segments connate, usually with six ventral segments visible in both sexes, sometimes seven, very rarely eight; anterior and middle coxæ more or less spherical; wing venation more regular, areola oblonga present; tarsi five-jointed, without exception.

This is a very large and important family and contains, at present, some 13,000 to 14,000 species, which are perpetually being added to. In temperate countries they are almost entirely terrestrial, being found under stones or bark, in moss, rotten wood, etc. and are very seldom seen on the wing: in fact in many species the wings are rudimentary and the elytra soldered together; in tropical countries, however, there are many arboreal genera, which freely make use of their wings. Both in the larval and the perfect state they are carnivorous and predaceous. A few species have been found eating the young seeds on the heads of Umbelliferæ or Compositæ, or feeding on growing corn (*Harpalus* and *Zabrus*), and *Harpalus ruficornis* has been recorded as doing extensive damage to strawberries.

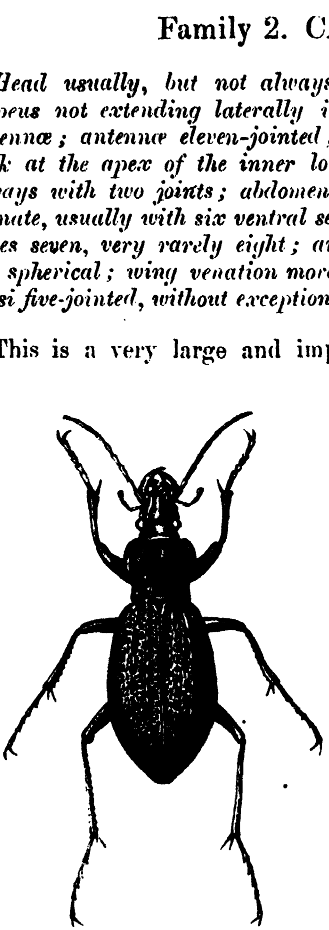

Fig. 24.—*Carabus cashmirensis.*

The larvæ of the CARABIDÆ are, as a rule, easily recognisable; they are, for the most part, elongate and very active, and may be chiefly known by the fact that the tarsi end in two claws, by their exserted strong and sharp calliper-like mandibles, and by the pair of cerci and the anal appendage at the end of the abdomen; these latter being very variable. Several of these larvæ will be found beautifully figured by Schiödte in his classical work, "De Metamorphosi Eleutheratorum Observationes" (Part iii).

With regard to the classification of the CARABIDÆ, much has been written; they have from the very first attracted collectors, and by many have been regarded (with the comparatively small family CICINDELIDÆ) as the head of the Coleoptera; but the tendency now is to place them at the end rather than at the beginning.

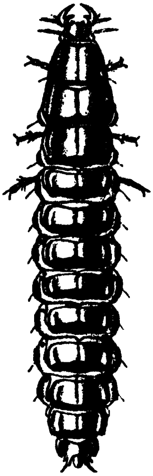
Fig. 25.—*Carabus cancellatus.* Larva × ¼. (After Schiödte).

There is much to be said for Lacordaire's classification of the group (Gen. des Coléoptères, Vol. i.), but the Legions, Sections, and Tribes are somewhat hard to follow, as he gives no initial tables. Moreover, he appears to be wrong in some points, as when he places the aberrant *Mormolyce* between *Thyreopterus* and *Catascopus*, under his tribe PERICALLIDES, and includes under the same section the PERICALLIDES and PSEUDOMORPHIDES. If we except the last named group and the MORMOLYCINÆ, the CARABIDÆ may be at once separated into two great divisions, the CARABINÆ and the HARPALINÆ, as follows:—

I. Mesothoracic epimera reaching the middle coxal cavities, which are not entirely enclosed by the sterna; anterior coxal cavities either open or closed behind .... *Carabinæ.*

II. Mesothoracic epimera not reaching the middle coxal cavities, which are entirely enclosed by the sterna; anterior coxal cavities closed behind; anterior tibiæ deeply emarginate in front .... *Harpalinæ.*

Of the middle coxæ Leconte and Horn (Classification of the Coleoptera of North America, p. xxiii) write as follows:—"The middle coxæ are surrounded by the meso- and metasternum; when the closure is not complete the coxal cavities are said to be open externally, in which case a trochantin is often visible, and the epimera reach the cavity; occasionally, as in CARABINÆ, the epimera form part of the outer margin of the cavity without any trace of trochantin."

In the aberrant genus *Mormolyce* the sides of the elytra form broad leaf-like expansions and the head is very elongate. Lacordaire considers it to be a *Thyreopterus* with the greater part of the organs monstrously developed; it differs from all the other members of the family in the fact that both the metasternal episterna and mesosternal epimera attain the middle coxal cavities.

Horn in his valuable monograph, "On the genera of CARABIDÆ with special reference to the fauna of Boreal America" (Trans. Amer. Ent. Soc. xv, 1888, p. 101), says that this genus is one of the most remarkable exceptions in the entire family. It is plainly by its structure otherwise allied to the TRUNCATIPENNES series but the mesosternal epimera reach the coxæ; nor does the exception end here, as the metasternal episterna also form part of the outer side of the coxal cavity, a character otherwise unknown in the ADEPHAGA outside the *Dytisci complicati*. It is obvious therefore that the MORMOLYCINÆ, although only containing one genus and three species (from the Malay Archipelago and Peninsula), must form a separate tribe or subfamily, and I was just about to make this arrangement when I found that Dr. Sharp had previously adopted it. The larvæ of *Mormolyce* appear to be truly Carabideous.

The PSEUDOMORPHINÆ form another quite aberrant group; they are utterly unlike the CARABIDÆ in facies, presenting an even outline like the GYRINIDÆ or some of the broad oval NITIDULIDÆ or SILPHIDÆ; they have, however, no affinity, except outward form, with any of these families. In the mesosternal structure they resemble the HARPALINÆ, from which they are distinguished by the fact that the head is furnished underneath on each side with a deep groove for the reception of the whole or part of the antennæ. Lacordaire records eighteen species from North America, Brazil, and Australia; at present about one hundred species are known.

We quote Dr. Sharp's table (Cambridge Natural History, vi, p. 206, 1899), taken partly from Dr. Horn, as it appears to us to be the best general division of the CARABIDÆ that has yet appeared.

1. Middle coxal cavities enclosed externally by the junction of the meso- and metasternum; neither epimeron nor episternum attaining the cavity.
   Head beneath, with a deep groove on each side near the eye for the reception of the antennæ or a part thereof.
   Sub-fam. 3. PSEUDOMORPHINÆ.

   Head without antennal grooves. Sub-fam. 2. HARPALINÆ.
2. Middle and coxal cavities attained on the outside by the tips of the episterna and epimera.
   Sub-fam. 4. MORMOLYCINÆ.
3. Middle coxal cavities attained on the outside by the tips of the epimera but not by those of the episterna.
   Sub-fam. 1. CARABINÆ.

These sub-families, as Dr. Sharp observes, are very uneven, the HARPALINÆ containing 10,000 or more species, the CARABINÆ 2000, the PSEUDOMORPHINÆ 100, and the MORMOLYCINÆ 3.

The subdivision of the great series of the HARPALINÆ has, of course, given rise to much controversy, and is very far from being settled. Horn separates them into two great sections, the *Harpalinæ bisetosæ* in which the head has two supra-orbital setigerous punctures, and the *Harpalinæ unisetosæ* in which the head has only one such puncture. Exceptions appear to occur in the genera *Pterostichus* and *Amara*, but the chief objection to the division is the forced grouping together of discordant elements, and the separation of allied groups; the LEBIINÆ for instance are in the former division and the BRACHININÆ is the second. Ganglbauer (Die Käfer von Mitteleuropa, i, pp. 30–32) gives a dichotomous table of all the groups founded chiefly on the under skeleton, the mouth parts, and the formation of the coxæ and tibiæ; but he makes use of Horn's division for the latter part of his table, and also indirectly of the divisions TRUNCATIPENNES and INTRUNCATIPENNES; the former include the BRACHININI, MASOREINI, DRYPTINI, LEBIINI, and ODACANTHINI, which form part of the HARPALINÆ. He further adopts the characters of the epimera and episterna given above for the separation of the CARABINÆ and HARPALINÆ, but leaves out of consideration the characters drawn by Bates (Biol. Cent.-Amer., Coleoptera, Vol. i), from the dilatation of the joints and the clothing of their underside in the male, which in many cases appear to be very valuable, although they break down in one or two groups.

Less than 500 CARABIDÆ are recorded from India in the Catalogue of Gemminger and von Harold, Vol. i (1868). Between twice and three times this number are now known, and this is probably only a small proportion of the species existing within the limits of the region considered in this work. That this is the case may be gathered from the "List of CARABIDÆ," by H. W. Bates (1892), in which he describes and notes the species collected shortly before by Fea in Burma and the adjacent regions in a comparatively short period. Signor Fea, who by no means confined himself to this group or order, paid considerable attention to the obscurer species, which have usually been so much neglected in tropical countries, and his researches, coupled with those of Mr. Champion in Central America, have revolutionised our ideas with regard to the geographical distribution of living forms. In a short time and over a small extent of country 207 new species and 15 new genera were obtained by Fea. As Mr. Bates' article is not easy of access and as it was his last work before his death, it may be of service to Indian students to quote the concluding portion of his preface:—"One or two obvious conclusions are suggested by even a cursory glance at the present list. One is the close relationship between the carabideous fauna of the Irawadi Valley and that of Assam or the valley of the Brahmaputra, showing that the mountainous region constituting the watershed of the Irawadi is not high enough to serve as a barrier to the migration of either terrestrial or arboreal species of the group, a conclusion confirmed by the numerous cases in which the same species inhabit the Naga and Khasia Hills. A close faunistic relation exists also with the lower Gangetic Valley on the west and the great river basins of the Indo-Chinese countries to the east, as also with the lower valley of the Yangtsze-Kiang, Eastern China and Japan. Another conclusion is the lack of any striking speciality of the Burmese Fauna in this family of Coleoptera. Most of the new genera belong to the obscurer groups of the family, the tropical Asian members of which have hitherto been much neglected, and some of them will doubtless be found to occur in the neighbouring regions. Even the hilly regions to which Signor Fea judiciously devoted his principal attention at altitudes of 5000–6000 feet, failed to reveal distinct traces of a special fauna: in this respect differing much from the mountainous districts of Sze-Chuen and Southern China. These conclusions, however, are premature; but they have seemed to me useful to state, as showing the great interest of the problems of geographical distribution, on which light is sure to be thrown by further researches conducted in the same intelligent and thorough manner as those of Leonardo Fea" (Ann. Mus. Civ. Genova, (2) xii (xxxii), 1892, pp. 268–269). In this connection we ought also to refer to the valuable catalogue of the Coleoptera of the Oriental Region by E. T. Atkinson (Journ. Asiatic Soc. Bengal, Supplement, 1890), which is indispensable for any worker at the Asiatic or Indian CARABIDÆ.

If we consider the Indian members of the group we shall find that such genera as *Carabus*, *Calosoma*, *Pterostichus*, *Amara*, *Calathus*, *Harpalus*, *Anchomenus*, and *Bembidium* are very poorly represented or almost absent. *Tachys* appears to take the place of *Bembidium*, *Colpodes* of *Anchomenus*, and *Abacetus* of *Pterostichus*; while *Clivina*, *Chlænius*, and the BRACHININA (*Brachinus* and *Pheropsophus*) are very numerous in species, particularly the two former. *Casnonia*, *Drypta*, *Dendrocellus* and their allies are typical Indian beetles, and of these the small ant-like *Selina westermanni* is one of the most curious and interesting. *Tetragonoderus* and *Catascopus* are well represented, but *Lebia* contains only eight species, all from North India or Burma.

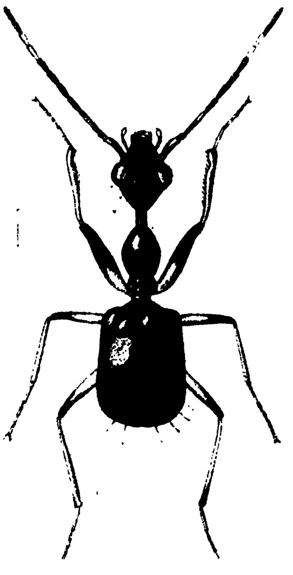

Fig. 26.—*Selina westermanni.*

The genus *Omophron* in the catalogue of Mr. Atkinson, before referred to, contains only four Indian species, but in his supplement he has added six more; this shows how little we can trust to our present lists. In passing, it is worth mentioning that M. Lameere in his recent classification of the Coleoptera (Ann. Soc. Ent. Belgique, 1900, p. 355, and 1903, p. 155) places this last named genus among the DYTISCIDÆ, just before the HALIPLIDÆ, because the mesosternum is covered by the prosternum as in the last named family. The habitat of *Omophron*, moreover, is subaquatic, as the species live on the edge of water, usually hidden in the sand. Lameere's arguments (*l. c.* p. 376) seem plausible, but have not hitherto met with acceptance. The genus *Cyclosomus*, of which three species occur in India, is very like *Omophron* in facies, but has no affinity with it. Of the other genera, *Scarites* possesses a considerable number of species, while *Omphra* and *Oxylobus* appear to be confined to India and Ceylon. Many other points might be mentioned, but they must be left to the specialist who may be able to take up the volume on the Indian CARABIDÆ.

[Family 3. AMPHIZOIDÆ.*]

Antennæ inserted just in front of eyes, short, eleven-jointed, without pubescence: pronotum short and much narrower than elytra, which are ample and ovate: outer lobe of maxilla not jointed; legs not formed for swimming; anterior coxæ globular: metasternum with a very short ante-coxal piece, the suture indistinct; metasternal episterna and mesosternal epimera both reaching the middle coxal cavity (as in part of the Dytiscidæ *and the Carabid genus* Mormolyce); *venation of wings somewhat irregular but plainly adephagid; areola oblonga distinct.*

This family consists of one genus containing three species rather resembling Heteromera in appearance, two of which live in the west of North America and one in Tibet.

They do not swim, but live in very cold, rapid streams, and cling to stones and timber like *Macronychus* and *Elmis*. Owing to the fact that the metasternal episterna and mesosternal epimera both reach the middle coxal cavity, Dr. Sharp at first classed the genus with the DYTISCIDÆ, in his series *Dytisci complicati*; but in his more recent work he regards the family as separate and places it between the CARABIDÆ and PELOBIIDÆ, which is, almost certainly, its proper place, as *Amphizoa* is much more of a Carabid than a Dytiscid: it is exceedingly interesting as a transitional genus. Sharp (Cambridge Natural History, vi, p. 207) figures the larva of *A. lecontei*; it resembles the larva of *Carabus*, but is broader, and at first sight bears a superficial resemblance to that of *Spercheus*; there is no anal tube and the cerci are short and pointed. The larva also is transitional, for, as Dr. Sharp points out, it is Carabid as regards the mouth, but Dytiscid of a primitive type, as regards the abdomen and stigmata.

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* The names of the families which are not yet known to occur within our limits are placed in square brackets.

[Family 4. HYGROBIIDÆ (or PELOBIIDÆ).]

Head not sunk in prothorax; antennæ inserted at the side margins of the forehead, eleven-jointed, without pubescence; metasternum with a very short ante-coxal piece, the suture indistinct; anterior coxæ conical; metasternal episterna not reaching the middle coxal cavity; hind legs slender, but formed for swimming, with the tarsi longer than the tibiæ, and all the tarsi and tibiæ rather thickly set with swimming hairs; elytra with a stridulating file on their inner side at apex.

This family is in several ways rather nearly related to the AMPHIZOIDÆ and like the latter family is closely allied to the CARABIDÆ; it differs from the first-mentioned family in being specially adapted for swimming, and, according to Sharp, it may be described as a Carabid adapted to a considerable extent for swimming in water. In his great work on the DYTISCIDÆ (Trans. Royal Dublin Soc. vol. ii, series 2, p. 255), Sharp classes the PELOBIIDÆ with his *Dytisci fragmentati*, but in his later work he regards them as a separate family between AMPHIZOIDÆ and HALIPLIDÆ.

The larva of *Pelobius* is very curious, its general appearance being crustacean rather than coleopterous. The head is broad and almost semicircular, the prothorax very large and trapezoidal; the scuta cover the whole upper surface of the segments; the last abdominal segment bears three long setose cerci, and the small anal process is retracted between them. Dr. Sharp's statement that there are three cerci is probably right; in my description of the larva (Col. Brit. Islands, i, p. 158), I have treated the third cercus as being the anal appendage, but it is apparently a somewhat abnormal cercus. The larva is furnished with branchiæ or gills on its under surface: it lives in water and is very predaceous.

The distribution of *Pelobius* is as strange as that of *Amphizoa*. When I wrote my book on British Coleoptera only three species were known, one from Europe, and the other two from Australia; since then a third has been added, from Chinese Tibet; representatives may very likely be found in Northern or Southern India.

[Family 5. HALIPLIDÆ.]

Antennæ inserted on the front, just inside the eyes, ten-jointed, not pubescent; clypeus extended on each side of the insertion (as in the CICINDELIDÆ); *metasternum with the antecoxal piece marked by a sutural line extending from one side to the other; anterior and middle coxæ globular, posterior coxæ fixed and covered with large plates concealing the greater part of the abdomen; legs slender, adapted for swimming.*

The HALIPLIDÆ are all small insects and their distribution is mostly Palæarctic, although a few occur in Central and South America, and also in Australia. No species has yet been recorded from India. They are chiefly distinguished by the large plates on the abdomen; a parallel structure occurs in the Carabid genus *Omophron*, as observed above, and for this reason some authors have proposed to associate *Omophron* and *Haliplus*.

The most remarkable point about the HALIPLIDÆ is their larvæ, which are furnished at the sides with longer or shorter processes. In *Haliplus fulvus* each scutum is furnished with four large stout spines which are double as long as the segment that bears them, and point backwards toward the apex; there are no cerci and the anal appendage is very long and divided before the apex into two setose processes; according to Schiödte there are eight pairs of abdominal spiracles. The larva of *Cnemidotus* is very extraordinary, its whole body being furnished with very long filamentous branchiæ; there are no spiracles and air is obtained by means of tracheæ traversing these filaments, which are fixed not on the segment directly, but on long spinose processes such as are found in *H. fulvus*. The HALIPLIDÆ are found in both stagnant and running water under moss or other water-plants or among stones, and they appear to swim by alternate movements of the hind legs. As we have before remarked the HALIPLIDÆ have very little in common with the DYTISCIDÆ, with which they have sometimes been classed; they are really nearer the CARABIDÆ and are worse swimmers than some of the sub-aquatic CURCULIONIDÆ. The weevil *Eubrychius velatus*, for instance, is a strong swimmer, using both hind legs like a Dytiscid, and it will live under water for an indefinite time.

Family 6. DYTISCIDÆ.

Antennæ inserted close to the eye and close to the upper portion of the base of the mandibles, eleven-jointed, glabrous and shining, and entirely destitute of setæ or pubescence; head short and broad, sunk in the prothorax as far as the eyes, clypeus not extending laterally beyond the insertion of the antennæ; metasternum without any cross suture, produced behind into an angular process; hind coxæ very large, soldered with and appearing as part of the metasternum, reaching the margin of the elytra; posterior legs modified for swimming, tibiæ and tarsi furnished with swimming hairs, as a rule broadened and flattened; abdomen with six visible ventral segments.

The great authority on this group is Dr. Sharp, and his exhaustive work "On Aquatic Carnivorous Coleoptera or Dytiscidæ," published in the Transactions of the Royal Dublin Society (vol. ii, series 2, 1880–2), is by far the most important that has yet appeared. He divides the Dytiscidæ into two great series, the *Dytisci fragmentati* in which the metathoracic episternum does not reach the middle coxal cavity, and the *Dytisci complicati* in which the metathoracic episternum reaches that cavity.

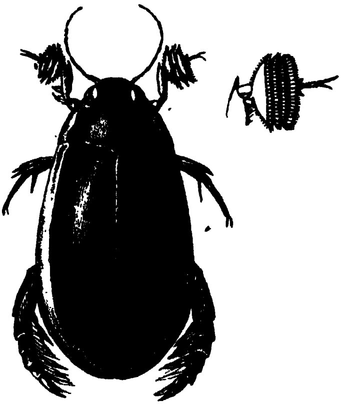

Fig. 27.—*Dytiscus* (*Trogus*) *limbatus* and the under surface of the front tarsus (enlarged).

Excluding the Hygrobiidæ or Pelobiidæ and the Amphizoidæ, which Dr. Sharp now considers to be separate families, we have the following table, drawn up by him; the divisions, however, as will be seen, are of very different values.

I. *Dytisci fragmentati.*
  - i. Greatest anterior extension of the hind coxa near the middle (longitudinally) of the body; metasternum more or less pointed in the middle behind, and not marked by a transverse suture .... NOTERINÆ.
  - ii. Greatest anterior extension of the hind coxa nearer to the epipleura than to the medial line of the body.
    - 1. Prosternal process not reaching the metasternum .... VATELLINÆ.
    - 2. Prosternal process reaching the metasternum. LACCOPHILINÆ.

II. *Dytisci complicati.*
  - i. Prosternum deflected between the front coxæ so that the prosternal process is placed on a quite different plane of direction from that of the prosternum; the latter not incrassate along middle; front tarsi usually 4-jointed.
    - 1. Prosternal process much deflected from the plane of direction of the prosternum. Front tarsi usually with only four joints .... HYDROPORINÆ.
    - 2. Prosternal process but little deflected from the plane of direction of the prosternum; front tarsi 5-jointed; scutellum not visible. METHLINÆ.
  - ii. Prosternal process on the same plane of direction as the prosternum; front tarsi 5-jointed.
    - 1. Inferior spur of hind tibia not or but little broader than the other.
      - A. Hind margins of joints of posterior tarsi not set with flattened and adpressed cilia.
        - *a.* Stigmata of last two dorsal segments not, or but little, broader than the preceding ones; outline of eye notched by the free margin of front of head .... COLYMBETINÆ.
        - *b.* Stigmata of the last two dorsal segments enlarged, each on the penultimate segment being about one-fourth of the total breadth of the segment; circular outline of the eye uninterrupted ...... DYTISCINÆ.
      - B. Hind margins of joints of posterior tarsi provided externally with flattened adpressed cilia .... HYDATICINÆ.
    - 2. Inferior spur of the hind tibia dilated, much broader than the other .... CYBISTRINÆ.

The VATELLINÆ are small insects with somewhat of the outline of *Amphizoa*, the swimming legs being very slender and not dilated; the three genera are all from South or Central America. The subfamily METHLINÆ consists only of three species from Tropical Africa, Madagascar, Mesopotamia, and Egypt; they are of the shape of small *Hydropori*, with the swimming legs very feeble and the extremity of the body acuminate or spinose. The other divisions are well known. The characters of the divisions are in some cases rather intricate, but they will be found workable; the general facies of the insects is a very important character in the group, and this can only be learnt by actual experience. We agree with Dr. Sharp in believing that, although the DYTISCIDÆ exist in water as larvæ and perfect insects, yet there are reasons for supposing that they are terrestrial insects which have become modified for a more or less aquatic life. The reasons are, firstly, that in general organization they are similar to the CARABIDÆ and are more easily drowned than many land-beetles, much more easily, for instance, than several of the subaquatic RHYNCHOPHORA before referred to; secondly, that they are capable of existing on land, and of taking prolonged flights in the air (on hot days they are often found on or close to the glass of garden frames, etc. which they have mistaken for water, thus proving that they are guided by sight and not by smell or any other sense); thirdly, that the pupa is always terrestrial; the pupæ of *Hyphydrus* for instance, may be found in numbers in summer in the drying or dry mud of the sides of pools, well above high-water mark; and fourthly, that like the Cetacea, they cannot live without coming to the surface for air, which is taken in under the elytra by the insect exposing the hind tip of its body just above the surface.

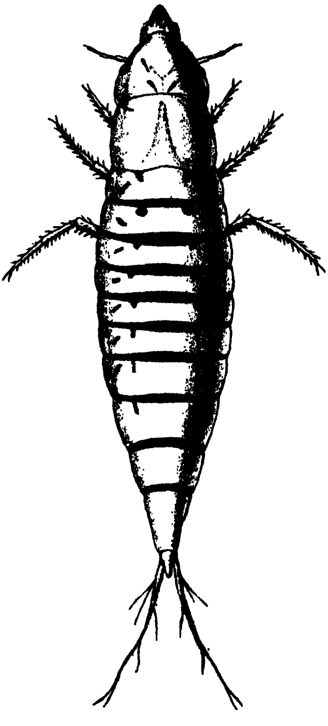

Fig. 28. — *Hydroporus parallelogrammus*. Larva × 10. (After Schiödte).

In *Dytiscus* the females are often deeply grooved on the back, thus affording the male a better hold, although it hardly requires it, as the front foot is dilated into a remarkable palette, covered with suckers of various sizes (fig. 27); dimorphic forms of the female resembling the male also occur. In many of the smaller species (*Hydroporus*, etc.), the males are bright and shining and the females dull, the sculpture being rougher.

The larvæ of the DYTISCIDÆ are long insects with large, more or less sickle-shaped jaws, which are not toothed, but are furnished with a lobe near the tip and another at the base and a canal passing through their length, through which they suck their prey after piercing it with the sharp tips. They vary in the shape of the cerci and anal appendages, number of joints of the antennæ, etc., and, in some species (e. g. *Hyphydrus ferrugineus*) the head is produced into a distinct horn, which is touched at about three quarters of its length from the base by the tips of the mandibles.

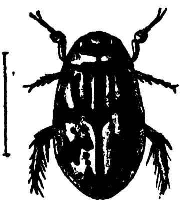

Fig. 29.—*Hydaticus festivus.*

The DYTISCIDÆ are for the most part characteristic of the Palæarctic region and seem to prefer, as a whole, cold to warmer water; they are, however, found all over the globe, and occur in brackish and more or less salt water as well as in fresh, in running streams or stagnant pools, and one or two species have been found in thermal springs. In all, about 1800 or 2000 members of the family are known. The Indian species appear to have been very little worked and the following genera are almost the only ones that seem to be at present known as occurring in the country:—*Dytiscus* (*Trogus*), *Hydrocoptus*, *Laccophilus*, *Hydrovatus* (several species), *Cybister*, *Hyphydrus*, *Hydaticus*, *Hyphoporus*, *Platynectes*, *Lacconectus*, *Bidessus*, *Copelatus*, *Canthydrus*, and the conspicuous and gaily coloured *Sandracottus* which are confined to India, Eastern Asia, the Malay Region, and Australia.

Family 7. GYRINIDÆ.

Antennæ inserted under the side margins of the forehead behind the base of the mandibles, very short and thick, eleven-jointed, the first cylindrical and cup-shaped, the second ear-shaped and ciliate on its margins, and the rest forming a closely adpressed club; eyes entirely divided into four; metasternum without suture; middle and hind legs both forming short broad paddles; abdomen with seven visible ventral segments, the first two closely united at the sides, connate in the middle.

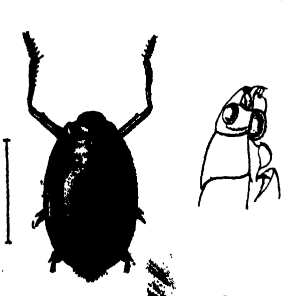

Fig. 30.—*Dineutes indicus*; and head, showing divided eyes.

These insects, commonly called "Whirligig Beetles," are well known to all observers; they are found, usually, in groups on the surface of the water, on which they swim with great rapidity, so swiftly in fact that the eye can hardly follow their motions. If much alarmed they dive below the surface of the water, but seem unable to keep down for more than a short time and soon reappear. The females, as a rule, are larger and duller than the males; the latter have the whole of the joints of the anterior tarsi dilated and furnished with very small round transparent suckers.

The larva of *Gyrinus* is very peculiar; the mandibles are provided with a sucking canal as in *Dytiscus*, and the larva, as a whole, would superficially resemble a Dytiscid larva, were it not for the long slender transparent tracheal gills with which the sides of the abdominal segments are furnished; each of the nine abdominal segments bears one of these on each side, and the last segment bears four, of which two may be regarded as cerci; the stigmata are obsolete, these gills occupying their places as breathing organs; they are also useful for locomotion. The eggs of *Gyrinus* are laid on aquatic plants and hatch in about eight days; when the larva is full-fed it leaves the water and spins a whitish cocoon on the stems of rushes or other aquatic plants; in about a month the perfect insect emerges, and immediately returns to the water. The cocoons of *Orectochilus* have been found beneath willow-bark a yard from the edge of a river and two feet above ground. The latter is a nocturnal insect and may be seen gyrating in the moonlight; in the day it hides on or under logs etc. The members of the genus *Dineutes* are large flat insects, much larger than *Gyrinus*; in this genus the outer lobe of the maxillæ is entirely wanting.

One of the most conspicuous species of the family is the large Javan *Porrorhynchus marginatus*, which is top-shaped, being broad and rounded behind and gradually narrowed off to a triangular and pointed head, the apex of the abdomen being furnished with four stout spines.

The GYRINIDÆ are widely spread throughout the world and are probably numerous in India; *Gyrinus*, *Dineutes* and *Orectochilus* are all represented. The position of the GYRINIDÆ has been discussed above (p. 50); the family is retained here, as having distinct relations with the Adephagid series, and especially with the DYTISCIDÆ, although it is certainly abnormal. It seems, however, to be still more out of place in any other section, and perhaps would be best treated as an entirely isolated family.

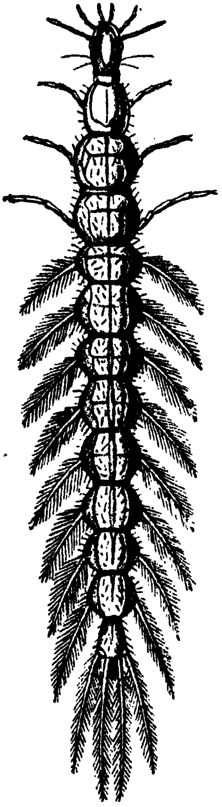

Fig. 31.—*Gyrinus marinus*. Larva × 6. (After Schiödte.)

Family 8. PAUSSIDÆ.

General form rectangular, more or less depressed, very rarely subcylindrical; antennæ extremely variable, usually two-jointed, sometimes six- or ten-jointed, in one genus eleven-jointed, usually of extraordinary form; elytra truncate behind, with the pygidium usually exposed; tarsi five-jointed; wings with Adephagid venation, the areola oblonga being distinct.

Owing chiefly to the very variable, strange, and abnormal development of the antennæ, and their general facies, the PAUSSIDÆ present some of the most extraordinary forms among the Coleoptera, and there has been considerable difference of opinion regarding their true position; as long ago as 1844 Burmeister placed them among the ADEPHAGA, next to the CARABIDÆ, but Lacordaire excluded them from the group and placed them between the PALPICORNES (*Cercyon*) and the STAPHYLINIDES. Before this time Latreille classed them with the SCOLYTIDÆ and BOSTRYCHIDÆ, and Westwood, although not committing himself definitely, seems to have inclined towards placing them near the CUCUJIDÆ. Raffray (Nouv. Arch. Mus. Paris (2) ix, pp. 354–359) discusses the whole question at length, and comes to the conclusion that they are a very well-marked abnormal group, not intimately connected with any other, but with closer affinities to the CARABIDÆ than to any other family. Sharp agrees with Raffray, but places the family at the beginning of his third great series POLYMORPHA, and not with the CARABIDÆ. Desneux, the most recent writer on the group ('Genera Insectorum,' PAUSSIDÆ, p. 3, 1905), considers the question as definitely settled by the researches of Raffray and, more recently, of Escherich. "Not only," he says, "have the PAUSSIDÆ more analogies with the CARABIDÆ than with any other family, but they are intimately united with them, for they are derived directly from them, their ancestors being found in a group akin to the OZÆNIDÆ, which, as Raffray has pointed out, have numerous characters common also to the PAUSSIDÆ." We can hardly, perhaps, consider the matter as quite settled, but the discovery of the genus *Protopaussus*, with its eleven-jointed simple antennæ, added to other considerations, leads us to believe that the family must be given at all events a somewhat more than provisional place among the ADEPHAGA.

The genera and species are very widely distributed throughout tropical and subtropical countries, and are well represented in India; as the Indian species are treated of in this volume, we need not here say more about them.

Family 9. RHYSODIDÆ.

Form elongate and subparallel; antennæ inserted under the side margin of the front, eleven-jointed, short and thick, moniliform; mentum very large, entirely covering the mouth-parts; prosternum long, anterior coxal cavities closed behind; mesosternum short, metasternum very long, without a cross-suture before the hind coxæ, the epimera, but not the episterna, reaching the middle coxal cavity; tarsi five-jointed; tibial spurs oblong, double on anterior, single on intermediate and posterior pairs; abdomen with six ventral segments, the first three connate, but with the sutures apparent; venation of wings Adephagid in their general characters, but with the areola oblonga wanting, there being only one cross-vein joining the median and subradial veins.

The position of the family has been regarded as very doubtful, and it certainly appears to bear relations towards the COLYDIIDÆ and CUCUJIDÆ, between which it is placed by several authors. It is now, however, generally regarded as purely Adephagid.

The family consists of two genera, *Rhysodes* and *Clinidium*: the former contains about seventy species, of which about a dozen occur in the Indian region; while to the latter belong about forty species, one of which is found in the Himalayan region and another in Burma. The life-history is apparently not known. The extraordinary genus *Stemmoderus* of Spinola (figured as a Rhysodid by Lacordaire, Atlas, pl. xx, fig. 5) ought apparently to be removed from the group.

Family 10. CUPEDIDÆ.

Elongate insects, differing somewhat in shape and in the size and structure of the antennæ; pronotum separated by sutures from the pleuræ of the thorax; ventral segments free, at most the first connate with the second, the first covered by the coxæ, with at most the hind margin free; elytra with lattice-like sculpture; wings of a primary Adephagid type, with the median and the other ordinary veins regular, and with at least twelve cross-veins, two of these, situated between the second median and first cubital, enclosing a space, which appears to represent the areola oblonga of the Carabid wing; metasternum with a cross-suture before the hind margin.

The position of this family has been, and still is, much disputed. Kolbe, in his earlier work (Allg. Zeitsch. Entom. 1903, p. 142), keeps the CUPEDIDÆ by themselves as his first group of the Coleoptera, the PROTADEPHAGA. In his later work (Zeitsch. Wiss. Insectenbiol. iv, 1908, pp. 153, 246, 390) he very much modifies this opinion, and removes them from the ADEPHAGA altogether. The family seems to bear relations to the TEREDILIA of authors, and it is placed by Lacordaire between his LYMEXYLONES and PTINIORES. Lameere (Ann. Soc. Ent. Belgique, xliv, 1900, p. 359) considers *Cupes* to be closely allied to *Lymexylon*, as one of the most primitive of all beetles, but in his second paper, before referred to, he divides the ADEPHAGA into CUPEDIFORMIA and CARABIFORMIA, making the former the lowest group of the Coleoptera.

We are inclined to agree with this latter view. The wing venation has decided affinities towards that of the ADEPHAGA (see p. 41), and the presence of sutures separating the pronotum and the pleuræ seems to be a very strong point in the same direction. The presence of such sutures, as pointed out by Mr. C. J. Gahan (Ann. & Mag. Nat. Hist. (8) v, 1910, p. 57), seems to be confined to the ADEPHAGA, and, in his opinion, is one of the most distinctive characters of that suborder. These sutures are well marked in *Omma* and *Tetraphalerus*, and are present, although not so distinct, in *Cupes*. It is true that they apparently occur in a few other genera, apart from the ADEPHAGA, as in *Crymodes* (PYTHIDÆ) etc., but there are no true sutures in these cases. Apart from these characters we should be inclined to class the CUPEDIDÆ with the MALACODERMATA, especially the LYCINÆ.

The insects belonging to the genus *Cupes* are somewhat like *Cantharis* (*Telephorus*) in general shape; they possess long and stout antennæ, which, in some species at any rate, are thickened and serrate for about half their length; superficially they are quite unlike the ADEPHAGA. Very little is known of their habits, and what is known does not appear to point to their being carnivorous. Say (Boston Journ. Nat. Hist. i, p. 168) says of *Cupes cinerea* that it is common in old houses made of wood, from which Lacordaire argues that it is a wood-feeding insect like most of the PTINIDÆ; it may, however, be parasitic, like *Corynetes*, *Teretrius*, *Trypanæus*, etc. The few species of *Cupes* known are found in North and South America and the Philippine Islands, one also occurring, rather strangely, in Eastern Siberia, Japan, and Burma. The typical *Omma stanleyi* is found in Australia.

Sub-Order II. *POLYCERATA.*

(=POLYMORPHA, Sharp; POLYPHAGA, Ganglbauer, *ex parte.*)

We have before discussed this sub-order (p. 48), and need here say but little more with regard to it. Considering that the names of the main divisions have mostly been based on antennal characters (CLAVICORNIA, SERRICORNIA, LONGICORNIA, etc.), it might be well to adopt the term POLYCERATA, rather than POLYPHAGA or POLYMORPHA; but this is, of course, merely a matter of taste. As here considered, the sub-order differs from the POLYPHAGA of Ganglbauer (Münch. Kol. Zeitschr. 1903, Band i, Lief. iii, p. 302) only in not including the LAMELLICORNIA.

In subdividing the sub-order, the CLAVICORNIA and SERRICORNIA (including the MALACODERMATA) are considered, for convenience' sake, as having a separate equivalent value and are not included under the larger complex named by Ganglbauer DIVERSICORNIA. Ganglbauer himself has at different times considerably altered his views on some of these points (*cf. l. c. supra* with Die Käfer Mitteleurop. vol. iii, p. 408, and vol. iv, pp. 1–3), and will probably be found to have altered them further when the remainder of his valuable work has been published; at present, this has only reached the conclusion of the CLAVICORNIA.

The groups here adopted may be divided as follows:—

I. Wings belonging to Type II (p. 40), without cross-veins or loop .... *STAPHYLINOIDEA*, p. 71.

II. Wings belonging to Type III (p. 42), but with the venation very variable, especially in the smaller forms.

  i. Gular sutures and lateral sutures of the prothorax distinct.

    1. Tarsi variable, with 1–5 joints, rarely heteromerous (in one or both sexes of certain CLAVICORNIA).

      A. Antennæ, as a general rule, clavate (with exceptions) .... *CLAVICORNIA*, p. 95.

      B. Antennæ, as a general rule, serrate or filiform (with exceptions) .... *SERRICORNIA*, p. 131.

    2. Tarsi heteromerous, that is to say, with 5–5–4 joints respectively (except the male of *Mophon*, which has the anterior tarsi 4-jointed). *HETEROMERA*, p. 155.

    3. Tarsi pseudo-tetramerous or crypto-pentamerous, the fourth joint being very small and connate with the fifth .. *PHYTOPHAGA*, p. 176.

ii. Gular sutures and lateral sutures of the prothorax obsolete; head usually (but not always, *e. g.*, ANTHRIBIDÆ and SCOLYTIDÆ) prolonged into a rostrum; tarsi as in the PHYTOPHAGA (except in one or two instances, such as *Dryophthorus* and *Anoplus*)................ *RHYNCHOPHORA*, p. 189.

The weakest point of the above table is the distinction between the CLAVICORNIA and SERRICORNIA; but in the absence of a satisfactory alternative, this purely artificial division is here adopted for convenience' sake. The venation of the wings, as we have said before, tends to break down in some of the groups, especially in the RHYNCHOPHORA, although on the whole it is very useful.

Division I. STAPHYLINOIDEA.

This group is distinguished by having the wing-venation belonging to the second type, which differs from the first in having no areola oblonga and from the third in not having the median vein recurved into a loop behind the middle (pp. 40, 41). The smaller forms often have the venation much reduced, and in one or two genera the wings are altogether wanting. The antennæ are simple, filiform, subfiliform, slightly thickened towards the apex or distinctly clavate, but never lamellate; the number of the tarsal joints is variable; the testes are follicular, but sessile and not stalked, and the male genital organs possess two pairs of accessory glands; there are four Malpighian tubes. According to Ganglbauer the larvæ are campodeiform, or not far removed from that type, but never maggot-shaped or vermiform; certain of the larvæ of the HISTERIDÆ, however, are much more maggot-shaped than campodeiform.

The wing venation in this division is fairly homogeneous, and the division as a whole appears to be a natural one, although, as in all such cases, there are certain transitional families.

Key to the Indian Families.

I. Elytra much abbreviated, leaving the greater part of the abdomen exposed (except in certain OMALIINÆ); dorsal segments of the abdomen mostly corneous.

i. Abdominal segments flexile; size very variable; tarsal joints varying in number, but nearly always more than three................................ **Staphylinidæ**, p. 72.

ii. Abdominal segments partly connate; size, as a rule, very small; tarsi three-jointed. **Pselaphidæ**, p. 80.

II. Elytra covering, or almost entirely covering, the abdomen; dorsal segments of abdomen (except where exposed at apex) membranous.

i. Antennæ not geniculate.

1. Wings in part or entirely fringed with longer or shorter ciliate hairs; size very small.

A. Posterior coxæ laminate; insects, as a rule, capable of rolling themselves into a ball .... **Clambidæ**, p. 85.

B. Posterior coxæ not laminate.

a. Antennæ verticillate, with long hairs; wings with long fringes of hairs; tarsi three-jointed; form almost always oblong .... **Trichopterygidæ**, [p. 86.

b. Antennæ loosely clavate, without long hairs; wings with much shorter fringes of hairs; tarsi four-jointed (third joint very small); form more or less hemispherical .... **Corylophidæ**, p. 88.

2. Wings without fringes of hairs

1. Posterior coxæ slightly transverse, conical, small; eyes coarsely granulated; size, as a rule, very small .. **Scydmænidæ**, p. 82.

2. Posterior coxæ strongly transverse; eyes finely granulated (sometimes absent); size, as a rule, large or moderate.

A. Posterior coxæ contiguous or only slightly separated .... **Silphidæ**, p. 83.

B. Posterior coxæ widely separated.. **Scaphidiidæ**, p. 90.

ii. Antennæ geniculate.

1. Head and mandibles normal; tarsi short .... **Histeridæ**, p. 91.

2. Head very large, as long or nearly as long as prothorax; mandibles perpendicularly reflexed; tarsi very long and slender .... **Niponiidæ**, p. 93.

Family 11. STAPHYLINIDÆ.

Elytra very short, leaving the greater part of the abdominal segments exposed, except in very few cases (e. g. Omalium) *in which only the apical segments are uncovered; abdomen or hind-body usually elongate and more or less parallel-sided, with ten dorsal and seven or eight ventral segments, all entirely corneous, even when more or less hidden by the elytra (except in* Homalota, *where the first segment, which is almost or quite concealed by the elytra, is semi-membranous); head very variable in size (often varying in the sexes); antennæ variable in insertion and form, eleven-jointed or ten-jointed, filiform, subclavate or clavate; prothorax strongly* *inflexed beneath the body, the inflexed portion being often separated from the upper surface by a distinct ridge; prosternum variable, with the coxal cavities usually open behind; tarsi 5- 4- or 3-jointed; wings without cross-veins or enclosed areas.*

The chief character of the STAPHYLINIDÆ lies in their very short elytra, from which they derive their old name of BRACHELYTRA. But although these organs are so small, yet they conceal large and ample wings, which are very beautifully packed and folded away beneath them, and in spite of their apparent unwieldiness they can be almost instantaneously unfolded for flight. The refolding appears to take a longer time, and on warm days species of *Philonthus*, *Homalota*, etc. may often be seen alighting and running rapidly with their wings only folded laterally and reaching to the apex of the abdomen; but, as a rule, this is only for a few moments. Dr. Sharp (*l. c.* p. 225) says that "it is thought that the power of curling up the abdomen is connected with the packing away of the wings after flight; but this is not the case, for though the insect sometimes experiences a difficulty in folding the wings under the elytra after they have been expanded, yet it overcomes the difficulty by slight movements of the base of the abdomen, rather than by touching the wings with the tip." The author has observed a species of *Philonthus*, or an allied genus, when apparently in such difficulty, set all right by a sudden curling up of the abdomen, the wings disappearing smoothly under the elytra as if by magic; so far as could be seen, they were not touched by the tip of the abdomen but were driven home by a sudden push from its base.

The eyes in the STAPHYLINIDÆ are very variable, and rarely they are altogether wanting; sometimes they are very small, and in other cases again (e. g., *Stenus* and *Megalops*) they are very large and prominent, rendering the head the chief feature of the body. Two frontal ocelli are present in *Omalium* and one in *Phlœobium*. Some authors consider that the presence of ocelli testifies to the great antiquity of a family; thus Lameere says (Ann. Soc. Ent. Belgique, 1900, p. 373):—"La présence d'ocelles chez *Pteroloma* de la famille des Silphides et chez les Omaliiens de la famille des Staphylinides témoigne de la haute antiquité des Staphyliniformes." Whether this is true can hardly be proved, but it should probably be interpreted as the persistence of a character which has been lost in most species. Every student of Homoptera is familiar with the conspicuous frontal ocellus in certain CIXIIDÆ. When working at the CIXIIDÆ of Central America for the 'Biologia Centrali-Americana,' I found this ocellus varying much in size, even in the same species; in some species it was so small as to be hardly traceable, in others nothing was left but the cicatrix, and in yet others there was merely a spot marking the position it had perhaps once occupied in previous generations. The retention of the ocelli by even a few species of Coleoptera is, in any case, very interesting.

Among other points that may be noticed in the family are the mouth-parts, which are of considerable value in the classification of the various groups. The mentum is trapezoidal, with the anterior part separate; the ligula is, as a rule, membranous; in *Stenus* the ligula, paraglossæ, and labial palpi are very slightly jointed with the mentum, and are sometimes, at death, protruded at the end of a long gullet; the mandibles are sometimes hard and stout and furnished with at least one strong tooth; sometimes they are finer, sharp, and sickle-shaped; the maxillæ have two lobes, and the maxillary palpi are 4-jointed, with the last joint often very small and subulate; in *Aleochara* there is a very minute fifth joint in both the maxillary and labial palpi; these latter are

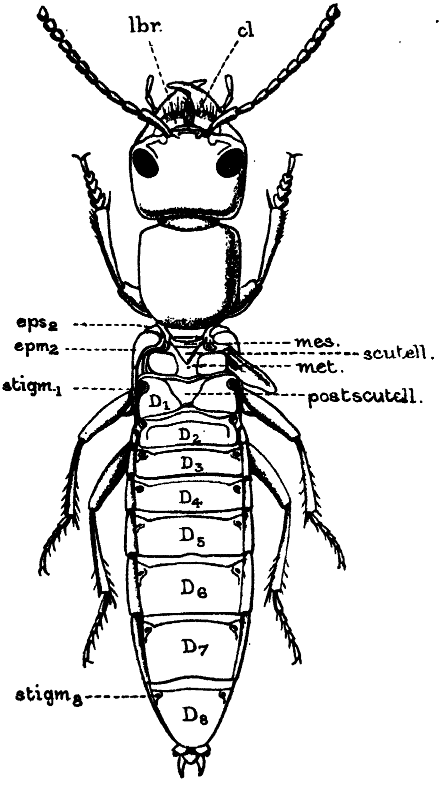

Fig. 32.—*Staphylinus tenebricosus.* Upperside (elytra removed): *lbr.*, labrum; *cl.*, clypeus; *mes.*, mesonotum; *eps*$_2$, *epm*$_2$, episterna and epimera of mesothorax; *scutell.*, scutellum; *met.*, metanotum; *postscutell.*, postscutellum or metanotal scutellum; *stigm*$_1$, first abdominal stigma; *stigm*$_8$, last abdominal stigma; D$_1$–D$_8$, dorsal segments of the hind body. (After Ganglbauer; lettering somewhat altered.)

usually 3-jointed, occasionally 2-jointed, as a rule of normal form, but in *Myllæna* and a few other genera they are more or less setiform.

The hind-body or abdomen is sometimes parallel-sided, sometimes strongly narrowed, and more or less conical; in very few instances is it wider behind than the elytra; it is usually more or less setose,

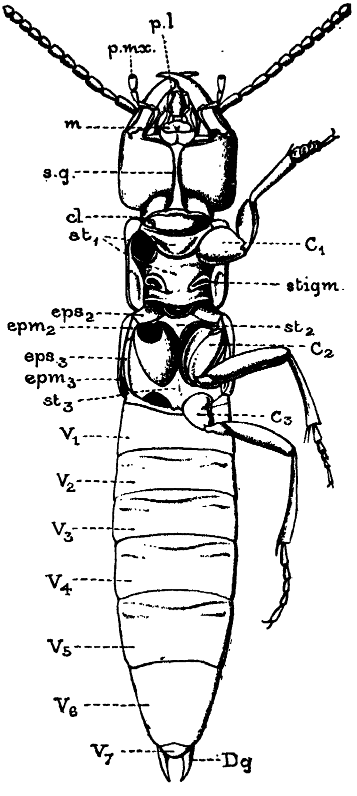

Fig. 33.—*Staphylinus tenebricosus.* Underside: *p.mx.*, maxillary palpus; *p.l.*, labial palpus; *m*, mentum; *s.g.*, gular sutures; *cl.*, clavicle; st_1, prosternum; st_2, mesosternum; st_3, metasternum; eps_2, epm_2, episterna and epimera of mesosternum; eps_3, epm_3, episterna and epimera of metasternum; *stigm.*, free stigma of the prosternum; C_1, C_2, C_3, coxæ; V_1–V_7, ventral segments of the hind body; *Dg*, anal styles, the side pieces of the completely divided segment. (After Ganglbauer; lettering somewhat altered.)

and very often bears at its apex two style-like processes. In many genera the modifications of the terminal segments, especially in the male, are of very great importance in determining species (*e. g.* in *Homalota*, *Tachinus*, etc.). In some species (e. g. *Encephalus*) the hind-body can be curved up over the back so as to cover the front portion; in others (e. g. *Xantholinus*) the abdomen is curved in underneath on any alarm, and the insect remains quite motionless and so is passed over by its numerous enemies.

The larvæ of the majority of the STAPHYLINIDÆ are closely allied to those of the CARABIDÆ in general appearance, and in shape and habits are very nearly related to one another, being long and linear and very active and rapacious; a few, however (such as *Syntomium*), are short and broad, and bear some analogy, at all events superficially, to the SILPHIDÆ. Descriptions of several, with beautiful figures, are given by Schiödte (De Met. Eleuth. part ii). As Lacordaire remarks, they approach nearer to the shape of the perfect insect than the larvæ of almost any other Coleoptera; they have no distinct labrum, and the body is well protected by corneous plates or scuta; the abdomen is terminated by an anal appendage, which is apparently used for locomotion, and by two cerci, one on each side; the legs are well developed, but have only one claw. As a rule, these larvæ prey on other insects, but occasionally, as in the case of *Bledius*, they appear to be themselves the victims, for there can be no doubt that the species of *Dyschirius* (CARABIDÆ), which are found associated with

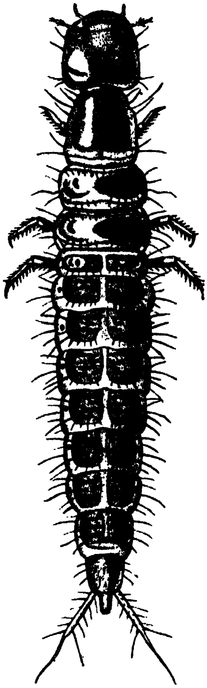

Fig. 34.—*Philonthus nitidus*. Larva × 5. (After Schiödte.)

certain *Bledii*, are really enemies, and not friends; they appear to attack the larvæ or perfect insect in their small burrows, and then occupy these themselves.

The pupæ of the family are not remarkable in shape, but are well worthy of notice from the fact that some are coated with a sort of exudation which glues the parts together and forms a hard coating, thus "obtecting" the whole, as in the Lepidoptera; the parts of the insect, however, are always visible, but the fact is a very interesting one as bearing upon the phylogeny of the Coleoptera.

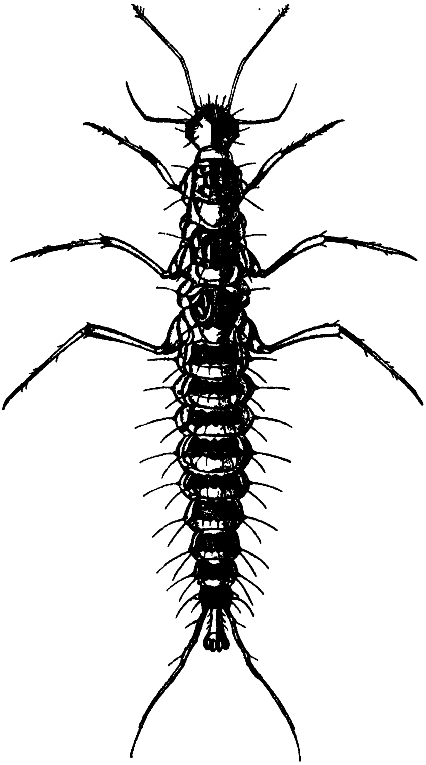

Fig. 35.—*Stenus bipunctatus.* Larva × 10. (After Schiödte.)

The habits of the STAPHYLINIDÆ are very varied and they are found in all sorts of situations, the greater number of them in dung-hills, decaying vegetable refuse, dead birds and animals, moss, dead leaves, etc. They are, for the most part, carnivorous, but some are vegetable-feeders, a large number being found in fungi or at sap; some are found in flowers, and many live under bark or in decaying wood, these being often adapted to their habitat by their flattened form; others, again, inhabit burrows on the banks of ponds or rivers or on the sea-shore, and several species occur considerably below highwater-mark in shingle and seaweed. A large number of all these feed on the various small insects, larvæ, pupæ, etc. that occur in their habitats, although many (*e. g.* the fungus-frequenters) certainly feed on the substances in which they are found.

A considerable number are found associated with ants, some of these exuding a fluid which is devoured by the ants (*Lomechusa*, *Atemeles*, etc.), while others probably act as scavengers; it is plain, however, that some are by no means friends, as they have been observed devouring ants. *Velleius* is only found associated with hornets. Certain species, such as *Ocypus olens*, assume a menacing attitude if disturbed, and a large number have the power of exhaling a strong and disagreeable odour.

There are some very conspicuous and brilliantly coloured members of the family, but the majority are sombre and unattractive and have therefore been passed over by collectors in favour of the more conspicuous Lamellicorns, Longicorns, etc.

The STAPHYLINIDÆ are very widely distributed throughout the world, although the family is apparently Holarctic rather than Tropical, and several of the chief genera are cosmopolitan. They have, however, as above remarked, been much neglected, and comparatively little is known of the Indian species. Erichson, in 1840, recorded the following genera from India:—*Myrmedonia*, *Tachinus*, *Xantholinus*, *Staphylinus*, *Quedius*, *Philonthus*, *Pæderus*, *Pinophilus*, *Osorius*, *Bledius*, *Leptochirus*, and *Palæstrinus*, the latter being peculiar to India. In Gemminger and Von Harold's Catalogue (1868) a considerable number of the common European genera are represented by Indian species, many of them being described by Kraatz from Ceylon; but in Duvivier's Supplement (1883) no further species from the country are added. It is to be feared therefore that it will be a long time before the STAPHYLINIDÆ of India can be dealt with in a monograph, although it is probably rich in species of the family, and a considerable number have more recently been described by Fauvel and others.

As the different tribes or groups are in so many cases the same as we find in Europe, we need not, and in fact could not, in the present state of our knowledge, go beyond the ordinary classifications.

The following is Erichson's classification:—

I. Prothoracic stigmata conspicuous.
  i. Antennæ inserted on the face at the interior margin of the eyes .... ALEOCHARINÆ.
  ii. Antennæ inserted under the lateral margin of the front .... TACHYPORINÆ.
  iii. Antennæ inserted on the anterior margin of the front .... STAPHYLININÆ.
II. Prothoracic stigmata concealed.
  i. Posterior coxæ conical.
    1. Prothorax with the space behind the anterior coxæ membranous .... PÆDERINÆ.

2. Prothorax with the space behind the anterior coxæ corneous.
  A. Antennæ inserted under the lateral margin of the front .... PINOPHILINÆ.
  B. Antennæ inserted on the front.......... STENINÆ.
ii. Posterior coxæ transverse.
  1. Posterior trochanters simple.
    A. Anterior coxæ conical and prominent .. OXYTELINÆ.
    B. Anterior coxæ globose and not prominent PIESTINÆ.
  2. Posterior trochanters used as a support or fulcrum.
    A. Anterior coxæ conical, exserted.
      a. Ocelli wanting .... PHLŒOCHARINÆ.
      b. Ocelli two .... OMALIINÆ.
    B. Anterior coxæ subcylindrical, not exserted .... PROTEININÆ.

The following classification, with a few alterations, is the one that I have myself adopted (Col. British Islands, ii, p. 5). After much consideration I have included the MICROPEPLINÆ; I am by no means convinced that the position which I formerly assigned to them between *Onthophilus* and the NITIDULIDÆ is not right, but I feel that, as Dr. Sharp has done far more work at the STAPHYLINIDÆ and NITIDULIDÆ than I have, it is best to follow him. He considers the MICROPEPLINÆ to be a subfamily of equivalent value to the ALEOCHARINÆ, etc.; Ganglbauer follows Sharp, and Leconte and Horn, Mulsant and Rey, Fauvel, and others are of the same opinion. The larva of *Micropeplus* is quite different from that of the usual Staphylinid larvæ, but is more nearly related to the latter than the larva of *Syntomium*, which is, of course, an undoubted Staphylinid.

I. Prosternum without furrows for the reception of the antennæ; antennæ eleven-, rarely ten-jointed.
  i. Antennæ inserted upon the front, near the inner margin of the eyes.
    1. Posterior coxæ large, contiguous; antennæ not terminated by a distinct club........ ALEOCHARINÆ.
    2. Posterior coxæ small, widely separated; antennæ terminated by a distinct club .. STENINÆ.
  ii. Antennæ inserted on the anterior margin of the head.
    1. Antennæ approximate; prosternum developed in front of the anterior coxæ ...... XANTHOLININÆ.
    2. Antennæ distant; prosternum not developed in front of the anterior coxæ........... STAPHYLININÆ.
  iii. Antennæ inserted under the sides of the front.
    1. Prothoracic stigmata conspicuous on removing the front coxæ.
      A. Posterior coxæ transverse.
        a. Antennæ filiform, not verticillate-pilose. TACHYPORINÆ.
        b. Antennæ capillary, verticillate-pilose .. TRICHOPHYINÆ.
      B. Posterior coxæ triangular, prominent; antennæ capillary and verticillate-pilose.............................. HABROCERINÆ.

2. Prothoracic stigmata difficult to perceive on account of the prominence of the sides of the prothorax.

A. Anterior coxæ short and conical.

a. **Tarsi two-jointed** .... Leptotyphlinæ.

b. **Tarsi four-jointed** .... Evæsthetinæ.

B. Anterior coxæ large, prominent and conical.

a. Vertex without ocelli.

*a**. Last joint of labial palpi dilated, very large, crescent-shaped ...... Oxyporinæ.

*b**. Last joint of labial palpi not, or not strongly, dilated.

a†. Posterior coxæ conical.

a‡. Palpi with the last joint very small, subulate.............. Pæderinæ.

b‡. Palpi with the last joint equal to the preceding .... Pinophilinæ.

b†. Posterior coxæ transverse.

a‡. Posterior trochanters small, one-fifth the length of the femora; head with a distinct neck .... Oxytelinæ.

b‡. Posterior trochanters large, one-third the length of the femora; head without a distinct neck.. Phlœocharinæ.

b. Vertex with two ocelli .... Omaliinæ.

C. Anterior coxæ transverse, sublinear.

a. Vertex without ocelli; elytra covering the greater part of the body .... Proteininæ.

This family may be divided into two natural sub-families :—

1. Antennæ with eleven joints, very rarely ten-jointed ; maxillary palpi much developed ..	PSELAPHINÆ.
2. Antennæ with from one to six joints ; maxillary palpi much reduced or rudimentary....	CLAVIGERINÆ.

Many members of this family are myrmecophilous, while some are never found except in ants' nests. In spite of their small size they are very interesting and striking insects, and seem from the first to have roused the interest of Coleopterists. In their short elytra and exposed abdomen they are, apparently, closely allied to the STAPHYLINIDÆ, but the segments are not by any means as free as in the last-named family, and have little and in some cases practically no power of movement. The maxillary palpi of the PSELAPHINÆ often present the most extraordinary forms, especially in the males of certain genera, but in the CLAVIGERINÆ the mouth-parts are very different and the palpi are much reduced ; the antennæ, moreover, have the joints much reduced in number, six being found in *Claviger*, two in *Adranes*, and one only in *Articerus*. For these reasons, and on account of the connate segments of the abdomen, the CLAVIGERINÆ have been regarded as a separate family ; but in all their other characters they are plainly to be referred to the PSELAPHIDÆ, and it appears best to consider them as abnormal members of the family ; but the question is still an open one.

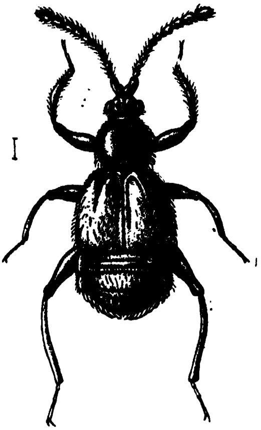

Fig. 36.—*Bryaxis horsfieldi.*

About 2500 species of PSELAPHIDÆ are known. Many of them possess excretory tufts of hair, such as are found in the PAUSSIDÆ, from which they exude a substance that is much liked by ants. In the case of *Claviger* the ants in return seem to support the beetles, which appear to have lost the instinct of feeding themselves, the association, however, is not altogether friendly, as *Claviger foveolatus* has been observed to devour ant-larvæ.

The species belonging to the family differ very much in shape: as a rule they are narrow in front and much widened behind; but some are broad and subparallel-sided, and others, as *Euplectus*, narrow and parallel-sided. Some extraordinary forms are figured in the most recently published work on the group by Raffray ('Genera Insectorum,' Wytsman, 1908). In his introduction Raffray, speaking of the geographical distribution of the group, says that it is spread throughout the world, but the species become more abundant in a damp tropical climate. Very little is known of the Indian members of the group, although they are probably very numerous; several European genera are represented, as *Ctenistes*, *Tychus*, *Batrisus*, *Bryaxis*, *Euplectus*, and *Trimium*; one species of *Claviger* has also been found, while several genera occur only in Ceylon. Raffray has quite recently described several new species, and a new genus (*Aphanethrix*) from the Nilgiri Hills, and any collector in India who takes up the group will be amply repaid.

[Family 13. GNOSTIDÆ.]

Very small insects, with the abdomen entirely covered by the elytra; antennæ three-jointed; tarsi five-jointed; apparent number of ventral segments three, the first, however, elongate and consisting of three connate segments.

This small family appears, through the five-jointed tarsi and covered abdomen, to be allied to the SCYDMÆNIDÆ, and through the formation of the antennæ and the connate segments of the abdomen to be closely related to the PSELAPHIDÆ (CLAVIGERINÆ). I have followed Sharp in regarding it as a separate family and placing it between the two families last mentioned. Only two species are known, which inhabit nests of ants of the genus *Crematogaster* and are found in Brazil.

Family 14. SCYDMÆNIDÆ.

Very small insects, of elegant form, which are closely allied to the SILPHIDÆ; *mentum transverse; antennæ eleven-jointed, inserted on the front, thickened or clavate; maxillary palpi long, with the first joint very small; anterior coxæ subovate, contiguous; posterior coxæ separated; elytra entirely, or almost entirely, covering the abdomen (pygidium occasionally exposed); abdomen with six visible segments; legs moderately long, tarsi five-jointed.*

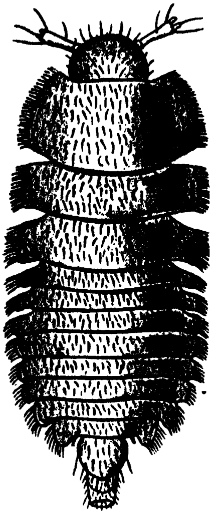

Fig. 37.—*Scydmænus tarsatus.* Larva greatly magnified. (After Meinert and Ganglbauer.)

The members of this family might be included under the **Silphidæ**, from which they only differ in one or two unimportant structural characters. In their general form, facies and size, however, they constitute a very distinct group, which, like the **Pselaphidæ**, seems always to have attracted the notice of Coleopterists. About seven hundred species are known, which are very widely distributed throughout the world. As a rule they are very homogeneous in appearance, but *Euthia*, *Cephennium*, and the large and aberrant species of *Clidicus* and *Mastigus* are very different from the typical forms. The species of the latter genus very closely resemble large ants, and many of the members of the family are myrmecophilous. Very little is known, however, of their life-history, but they appear, in some cases at all events, to feed on *Acari*, which are abundant in their habitats; many species are found in decaying grass, hot-beds and dead leaves, and many also occur in moss at the roots of trees, etc.

Not many Indian species appear to have been described, but they are probably very numerous; the genera *Scydmænus*, *Eumicrus*, and *Cephennium* are represented, while *Syndicus* and *Erineus* (with one species each) have only been recorded from India and Ceylon. The family contains at present about thirty genera.

Family 15. SILPHIDÆ.

Size extremely variable ($1\frac{1}{2}$–30 mm.); "mentum usually a transverse plate, having in front a membranous hypoglottis, which bears the exposed labial palpi, and immediately behind them the so-called bilobed ligula" (Sharp); *antennæ inserted under the margin of the front, thickened toward the apex or more often clavate; eyes finely granulate, sometimes wanting; anterior coxæ large, conical and contiguous; visible abdominal segments usually five, but sometimes four, six, or even seven; apex of abdomen often exposed; tarsi usually, but not always, 5-jointed.*

This family contains a large number of species (about 900) that are well known in the Palæarctic region, notably the "burying-beetles" (*Necrophorus*), and the roving carrion beetles (*Silpha*). The **Liodinæ** (**Anisotominæ**) have sometimes been erected into a separate family, but they appear to differ from the SILPHIDÆ only in the formation of the anterior coxæ and their surroundings. A large number of blind cave-insects of the genera *Bathyscia*, *Adelops*, etc., belong to the family.

The larvæ of the various genera are very different, those of *Necrophorus* being large, fleshy, inactive grubs, with small spinose plates on the dorsal segments, while those of *Silpha*, in most cases, are very active and are onisciform, or shaped like wood-lice, with the segments above entirely chitinous, the abdominal ones being furnished with lateral processes; they differ, however, considerably *inter se*.

One of the most peculiar genera belonging to the family is *Pteroloma*, Gyll., which superficially resembles *Nebria* and was included by all the older workers under the CARABIDÆ, until Erichson (Arch. Naturg. 1837, i, p. 119) pointed out its affinities to the SILPHIDÆ; it is remarkable for possessing two ocelli on the vertex, and the Japanese genus *Camioleum*, Lewis, which also has two ocelli, ought perhaps to be referred to the PTEROLOMINÆ. *Apatetica* is another genus of SILPHIDÆ, closely allied to *Pteroloma*, whose members very closely resemble species of *Lebia*; two species are known, one of which, *A. lebioides*, Hope, was originally found in the Himalayas.

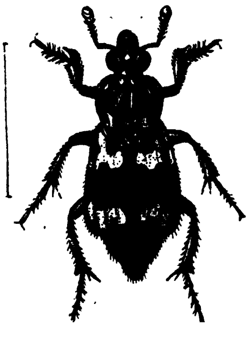

Fig. 38.—*Necrophorus nepalensis*

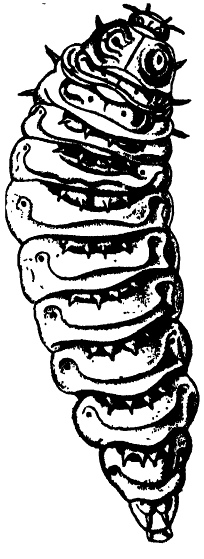

Fig. 39.—*Necrophorus vespillo*. Larva × 3. (After Schiödte.)

The SILPHIDÆ are for the most part confined to the Northern Hemisphere and are characteristic of cold and temperate countries; very few occur in the Tropics. *Necrodes*, *Necrophorus*, *Silpha*, and *Choleva* are each represented in India by one or two species, and possibly examples of the LIODINÆ, etc., may be discovered, but no one as yet appears to have worked at the group, so far as the Indian fauna is concerned.

The SPHÆRITIDÆ and CLAMBIDÆ have been classed with the SILPHIDÆ, but through the wing venation the former family approaches rather to the NITIDULIDÆ, and the ciliation of the margin of the wings appears to separate the latter.

The subfamilies may be distinguished as follows:—

I. Anterior coxal cavities closed behind.
  1. Episterna of mesosternum rather large and subquadrate; trochantins of anterior coxæ small, nearly or entirely covered .... CHOLEVINÆ.
  2. Episterna of mesosternum small and linear; trochantins of anterior coxæ larger and free .. LIODINÆ.
II. Anterior coxal cavities open behind .... SILPHINÆ.

Family 16. CLAMBIDÆ.

Minute, very convex, more or less hemispherical insects; head very large, as large as, or larger than, the pronotum when exserted; antennæ 10- or 8-jointed with a 2-jointed club; maxillæ with two narrow and rather long lobes; elytra without epipleuræ; wings in part finely ciliate on their edge; posterior coxæ laminate; tarsi 4-jointed; abdomen with five, six, or seven free segments.

The species of this family are closely related to the SILPHIDÆ on the one hand, especially to *Agathidium*, and they have the power of rolling themselves up like the members of the latter genus; they also have affinities towards the TRICHOPTERYGIDÆ and SPHÆRIIDÆ. The species are found under decaying bark, in decaying vegetable refuse, and in hotbeds, etc.

The larva of *Calyptomerus* has been described by Perris (Ann. Soc. Ent. France, 1852, pp. 574–577, pl. xiv, figs. 1–7); it is 2 mm. in length, elongate, and differs from the larvæ of some of its allies in being considerably narrowed in front and behind, with the greatest breadth at the metathoracic segment.

The species are almost entirely confined to Europe and North America; one species of *Clambus* has been described from Ceylon, and one from the Canary Islands.

[Family 17. LEPTINIDÆ.]

Mentum transverse with the posterior angles more or less prolonged; labrum very short; antennæ long, filiform; anterior coxæ small; metasternum very short; eyes entirely wanting or almost obsolete; tarsi five-jointed; size small.

This family is closely allied to the SILPHIDÆ, in which it is included by many writers; it differs in the shape of the mentum, the long and slender antennæ, the very short metasternum, and in the fact that the sternal epipleuræ of the elytra are almost obsolete or very little pronounced. Two genera are included in this family. One of these, *Leptinus*, is found in dead leaves, rotten wood, birds' nests, nests of field-mice, or even on the mice themselves; it also occurs in abundance in humble-bees' nests and very rarely in ants' nests; the true habits of the insect are therefore unknown. According to Sharp it has been suggested that the natural home of *Leptinus* (two species of which occur in Europe and one in America) is the bees'-nest, and that perhaps the beetle merely makes use of the mouse as a means of getting from one humble-bee's nest to another; this, however, is somewhat contradicted by the fact that the allied American genus *Leptinillus* is said by Riley to live on the beaver in company with *Platypsyllus*.

Family 18. TRICHOPTERYGIDÆ.

Very minute insects, the largest being under 2 millimetres in length, and the smallest about a quarter of a millimetre; antennæ with a three-jointed, more or less pronounced, club; maxillæ trilobed; tarsi three-jointed; elytra sometimes covering the abdomen, sometimes leaving the apex exposed; wings fringed on both sides by long hairs.

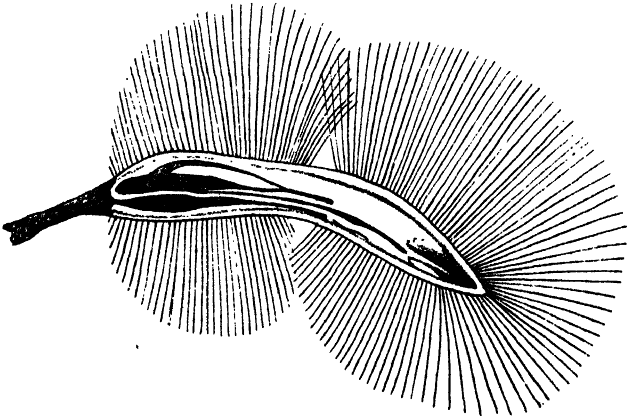

Fig. 40.—Wing of *Trichopteryx*. (After Matthews.)

The members of this family are probably more or less abundant throughout the greater part of the world, but they are usually overlooked by reason of their extreme smallness, *Nanosella fungi*, from South and Central America, being the smallest Coleopterous insect at present known. They are found in all sorts of places, among rubbish and leaves, under seaweed on the sea-shore, in fungi, under bark, in rotten wood, etc. The wings vary in shape, but are pedunculate and usually more or less lanceolate. The larvæ are elongate and parallel-sided, with a large triangular head and large eyes, and two hairy anal appendages; and the pupa is short and ovate.

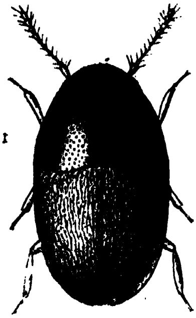

Fig. 41.—*Trichopteryx cursitans.*

The chief worker at the group has been the Rev. A. Matthews, whose accurate drawings of the details of these minute insects could hardly be surpassed.

Very little is known regarding the Indian species, but three or four species of *Trichopteryx* and one species of *Ptenidium* are known from Ceylon.

Some very curious forms have been described in the posthumous Supplement of Mr. Matthews' "Trichopterygia," published in 1900 by the late Mr. P. B. Mason of Burton-on-Trent, Staffordshire; of these *Championella*, *Dimorphella*, and *Mikado* are particularly noticeable.

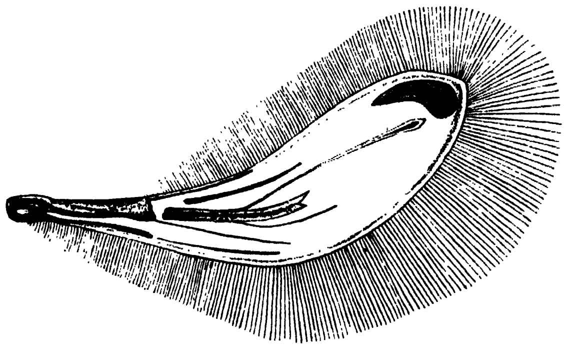

Fig. 42.—Wing of *Motschulskium.* (After Matthews.)

[Family 19. HYDROSCAPHIDÆ.]

Minute aquatic insects (from 1–2 mm. in length), elongate-conical in shape, with the abdomen produced and narrow, the produced portion being about as long as the elytra; antennæ short, eight-jointed (the apex of the long eighth joint being, according to Matthews, divided into two minute joints), subclaviform; wings broad, deeply fringed with hairs; tarsi three-jointed.

These extraordinary little insects, of which three or four species are known from Spain and North America, are really TRICHOPTERYGIDÆ modified for an aquatic existence. They appear to be found in running water.

[Family 20. SPHÆRIIDÆ.]

Minute hemispherical insects; head large, sessile, with the eyes large; antennæ short, 11-jointed, with the club well marked, obscurely 3-jointed; maxillæ feeble, bilobed; wings large and ample, deeply fringed with cilia; episterna of the metasternum long and narrow; all the coxæ transverse; the posterior pair very much enlarged, prominent, contiguous, extending to the sides of the body and to the fourth ventral segment.

The SPHÆRIIDÆ, through their ciliated wings, are evidently allied to the TRICHOPTERYGIDÆ, but apart from this, they present no special affinity to any particular group, as pointed out by Mr. Matthews, who took a great interest in this small family, and described four out of the six known species. In one or two points they are, perhaps, related to *Cercyon*. Their chief character is found in the great development of the posterior coxæ. As far as at present known they are entirely confined to Europe, and North and Central America.

Family 21. CORYLOPHIDÆ.

Minute insects; antennæ with the first or the two basal joints enlarged, 8- 9- 10- *or* 11-*jointed, clavate; maxillæ with one lobe, the palpi being of extraordinary form, with the second joint much dilated; abdomen with six free ventral segments; tarsi four-jointed, apparently three-jointed, the third joint being very minute and concealed by the emarginate or notched second joint.*

The chief points in this group appear to be the extraordinary form of the maxillary palpi (in many instances), and the abnormal and irregular antennæ in several of the genera such as *Anisomeristes* and *Microstagetus*. The number of joints is very variable, *Oligarthrum* possessing 8 joints only, *Corylophus* and *Arthrolips* 9, *Sericoderus* 10, and *Sacium* 11; the maxillary and labial palpi are large, with the second joint much dilated; the wings are fringed with hairs but very much less deeply than in the TRICHOPTERYGIDÆ, and the veins are obsolete except at the base.

The larvæ of *Orthoperus piceus* and *Arthrolips piceus* have been described by Perris; they are elongate-oval, the latter being shorter and broader, with a very small head and the prothorax much contracted in front; the sides of the segments in the former are set with strong forked setæ, and in the latter are separately prolonged into short blunt processes, terminating in setæ. The pupæ are of ordinary form.

The species are found in and under dry or rotting wood or bark, in decaying vegetables, hotbeds, fungi, etc. *Orthoperus atomarius* appears to be confined to cellars, where it feeds on the fungus *Zasmidium cellare.*

The species are probably very widely distributed throughout the world; species of *Sacium*, *Arthrolips*, *Anisomeristes*, *Sericoderus*, *Corylophodes* and *Lewisium* have been described from Ceylon, and one species of *Arthrolips* from Burma.

The CORYLOPHIDÆ have strong affinities with the SILPHIDÆ, has been pointed out by the Rev. A. Matthews, who has studied the group more than any other writer, and they are also closely allied to the TRICHOPTERYGIDÆ.

[Family 22. PHÆNOCEPHALIDÆ.]

Minute insects; antennæ 11-jointed, the last three joints forming an elongate club; head sessile, large and broad, deflexed; maxillæ bilobed with the lobes short; epimera of the mesosternum moderate: all the tarsi four-jointed, with the three basal joints of equal length, bilobed.

Mr. Matthews, who described this family, considers it as the connecting link between the CORYLOPHIDÆ and the SILPHIDÆ; it comprises the single genus *Phænocephalus*, which contains one species from Japan; it appears to be more nearly allied to the TRICHOPTERYGIDÆ than to the CORYLOPHIDÆ, but it is quite distinct from both of them.

[Family 23. PSEUDOCORYLOPHIDÆ.]

Minute insects; antennæ apparently 9-jointed, but really 11-jointed, the last three forming an apparently solid club; head large, retractile: maxillæ trilobed as in the TRICHOPTERYGIDÆ; *epimera of the mesosternum very large; wings ample, broadest at base, with distinct veins; all the tarsi 3-jointed; all the coxæ rounded and widely distant.*

This aberrant family is related to TRICHOPTERYGIDÆ, SILPHIDÆ, and COCCINELLIDÆ, and appears to be quite distinct from the CORYLOPHIDÆ. It comprises one genus *Aphanocephalus*, Woll., comprising six species: one from Brazil, and the remainder from

Penang, China, and Japan. The formation of the club of the antennæ will at once distinguish it from its allies; it appears to be a question whether it should be placed under the STAPHYLINOIDEA or the CLAVICORNIA.

Family 24. SCAPHIDIIDÆ.

Form more or less boat-shaped, with the elytra broadly truncate, and not covering the abdomen; antennæ 10- or 11-jointed, slender, with the five or six apical joints gradually thicker; pronotum large and fitting closely to the elytra; abdomen with six, seven, or even eight visible ventral segments; anterior coxæ contiguous; posterior coxæ usually widely separated; legs slender, tarsi long, filiform, 5-jointed.

The position of the family has been much disputed. Lacordaire placed it between the TRICHOPTERYGIDÆ and the HISTERIDÆ, Thomson regards it as near the NITIDULIDÆ, and Leconte and Horn as situated between the SPHÆRIIDÆ and PHALACRIDÆ. In the 'Biologia Centrali-Americana' (Coleopt. ii. 1, p. 158) Matthews places it between the SPHÆRIIDÆ and HISTERIDÆ, and according to him its chief characters are "the form of the anterior and intermediate coxal cavities; the protrusion of the wide pieces of the mesosternum beyond the normal outline of the skeleton; and (except in *Scaphium*) the reception of the posterior angles of the thorax into grooves on the epipleural fold of the elytra. The anterior coxal cavities are formed on their upper half by the prosternum and on their lower half by the mesosternum (a character found also in *Ephistemus*), and the intermediate coxal cavities extend in a similar manner into the metasternum."

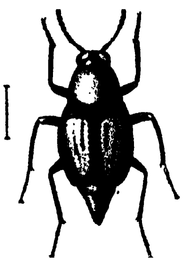
Fig. 43.—*Scaphidium nigrocinctulum.*

The members of the family in both the larval and the perfect state live in fungi. In the Munich Catalogue only fifty-one species are mentioned, but about 200 are now known. *Scaphidium* and *Scaphisoma* are represented in India and Ceylon. They are very rapid in their movements; the species of *Scaphidium* are often very brilliantly variegated with scarlet or yellow; the species of *Scaphisoma* are smaller, more sombrely coloured, and much more delicate insects.

The larva of *Scaphisoma agaricinum* has been described by Perris: it is of the Staphylinid type, with long hairs at the sides, with a very short anal appendage or proleg, and very short cerci.

Family 25. HISTERIDÆ.

Compact, hard, usually shining insects; antennæ geniculate, as a rule received in grooves beneath the pronotum, with a long basal joint, and a six- or seven-jointed funiculus, the last three or four joints forming an abrupt club; mandibles strong, maxillæ bilobed; pronotum closely applied to the elytra; elytra truncate, leaving the last two segments of the abdomen uncovered; abdomen with five visible ventral segments and seven dorsal, all hard; legs short and stout, retractile; tarsi short, usually five-jointed (posterior pair rarely four-jointed); anterior coxæ transverse, posterior coxæ widely separated; upper surface usually very smooth and shining, sometimes dull and with raised furrows.

This is a very large and well-defined family, containing, as at present known, about 1600 to 1700 species. The great majority of them are of a shining black colour with strongly engraved striation, but in the case of *Hister* and *Saprinus* a few species have bright red spots or markings, and some are more or less metallic. The shape is very variable and the variation is evidently due to habitat.

The species of *Hister* and its allies, which live in dung and decomposing carcases, are convex and very much polished, so that they always appear clean; they are often, however, much infested by Acari which secure a firm hold on their bodies. *Hololepta* and *Platysoma*, which live under the bark of trees, have the bodies much flattened, while *Trypanæus*, *Teretrius*, etc., which enter the burrows of wood-boring insects, are quite cylindrical and eminently adapted for their mode of life. The HISTERIDÆ have usually been considered to be for the most part feeders on dung, dead animals, etc., but it is probable that they are for the most part predaceous, both in the larval and perfect state, and that they inhabit decaying matter, not because it is their food, but because of the Dipterous larvæ, etc., which it nourishes. *Saprinus virescens* has long been known as feeding on the larvæ of *Phædon*, on *Sisymbrium*, etc., and *Hister helluo* has been recorded as feeding

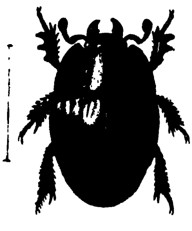

Fig. 44.—*Hister bengalensis.*

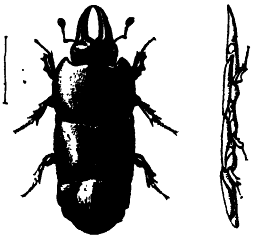

Fig. 45.—*Hololepta elongata* (and side view).

on larvæ of the Chrysomelid genus *Agelastica*, while *Hister pustulosus* attacks caterpillars of *Agrotis*.

A certain number of genera (e. g. *Hetærius* and *Myrmetes*) are only found in ants' nests; while others are occasionally found associated with ants; others again (*Hesperodromus*, *Discoselis*, *Termitoxenus*, etc.) live with Termites; their relations, however, to these insects are uncertain.

The larvæ of several genera are well known; they are distinguished by the absence of ocelli, the softness of their integument, the upper surface being often much wrinkled, and the short but well-marked two-jointed cerci at the apex of the abdomen. The larva of *Hister unicolor* is a broad flabby repulsive-looking insect with large jaws and extremely short legs, not visible from above; in *Platysoma* the form is narrower and more parallel and the legs are longer. These larvæ are carnivorous and very voracious.

In 1853–1862 the Abbé de Marseul monographed the family, but our knowlege of the group has since then been very much increased, in great measure through the exertions of Mr. George Lewis, who is at present the chief authority on the HISTERIDÆ.

Erichson in 1834 proposed three divisions of the family:—

1. Head porrected.
2. Head retracted into the prothorax; prosternum with a plate in front covering the throat, separated by a suture.
3. Head retracted into the prothorax: prosternum without a separated plate covering the throat.

Lacordaire (Gen. Col. ii, 1854, pp. 248–252) follows Erichson, but only adopts two divisions: the HOLOLEPTIDES with the head porrected, and the HISTERIDES with the head retracted; and he is followed by Leconte and Horn (Classification Col. North. Am. p. 144). Jacquelin Duval (Gen. Col. Eur. ii, 1857–1859, pp. 119–121) practically adopts the whole classification of Marseul, so far as the European Fauna is concerned, and gives an excellent table of the genera.

Marseul's classification is as follows:—

I. Head not retractile, horizontal, visible from underneath; mouth-parts projecting beyond the front of the prosternum.
    1. Mandibles projecting; clypeus not prolonged into a rostrum; body more or less flat and depressed .... HOLOLEPTINÆ.
    2. Mandibles retracted, covered by the long rostriform clypeus; body elongate, cylindrical (*Trypanæus*) .... TRYPANÆINÆ.

II. Head retractile, not visible from underneath when retracted; mouth-parts covered by the prosternum.
    A. Prosternum with a shorter or longer lobe or throat-plate, separated off by a more or less distinct suture.

3. Club of antennæ round or oval, pubescent, consisting of four joints, closely compacted, but separated by sutures .... HISTERINÆ.
4. Club of antennæ without sutures, smooth, cylindrical, truncate at apex.............. HETÆRIINÆ.

B. Prosternum without a lobe or throat-plate.
5. Antennæ inserted under the side margin of the forehead............................ SAPRININÆ.
6. Antennæ inserted on the forehead .... ABRÆINÆ *.

The genera *Hister*, *Saprinus*, and *Platysoma* are well represented in India, and among other genera found in India and Ceylon may be mentioned *Plæsius*, *Apobleptes*, *Paromalus*, *Onthophilus*, and *Abræus*. *Cypturus* was described by Erichson from the Himalayan region, and *Notodoma* is represented by one species described by Marseul from India. *Trypanæus* is confined to Tropical America, the Indo-Malay region, and Japan.

The very curious genus *Niponius* is closely related to the HISTERIDÆ, to which family it was assigned by its discoverer, Mr. G. Lewis, but it also bears affinities to other families, and is in several ways abnormal; we have therefore regarded it, with some hesitation, as provisionally separate.

Family 26. NIPONIIDÆ.

Form elongate, cylindrical; head large, nearly as broad, and sometimes as long, as prothorax; clypeus as a rule with horn-like projections; mandibles large and strong, perpendicularly reflexed; antennæ geniculate, with a round compact club, apparently three-jointed, but with the basal joint (the eighth of the antennæ) very small; pronotum parallel-sided, oblong, as broad as elytra; prosternum margined, rather narrowly dividing the transverse anterior coxæ, coxal cavities very narrowly closed behind; mesosternum very short, channelled; metasternum large, channelled, with long and narrow episterna; intermediate coxæ not widely divided, transverse; posterior coxæ more widely divided, but not very strongly as in Hister; *abdomen with five or six visible ventral segments; legs robust, tibiæ toothed externally, tarsi very long and slender, the last joint nearly as long as all the preceding four taken together.*

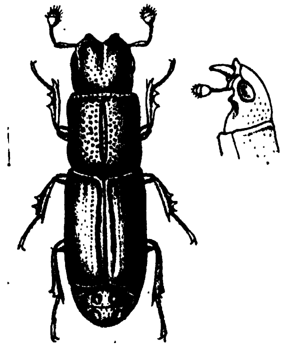

Fig. 46.—*Niponius canalicollis.*

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* See Ganglbauer, "Die Käfer von Mitteleuropa," ii, pp. 351-352.

It is with considerable hesitation that we adopt this family, but it will be noticed that the characters differ in several points from those of the HISTERIDÆ, of which family the single genus *Niponius* can only be regarded at the most as a very abnormal member.

Mr. G. Lewis, who first discovered the genus in Japan, was inclined to regard it at first as probably belonging to the SYNTELIIDÆ, to which family it bears a sort of superficial resemblance; when, however, he described it (Trans. Ent. Soc. Lond. 1885, p. 333), he referred to this, but went on to say that on a more perfect scrutiny of the insects he was convinced that they were true HISTERIDÆ, although their position in the family was hard to determine, there being much that is abnormal in their structure. He would place the genus near *Platysoma*, from the habits of the species and their mode of seeking food, but in the absence of an anterior prosternal lobe or throat-plate they are more closely allied to *Hololepta* and *Trypanæus*, and should come as a third tribe after the latter, if they are again relegated to the HISTERIDÆ. The formation of the head (which resembles more or less that of *Nemosoma* and *Osorius*), the large deflexed mandibles, the structure of the prosternum and coxæ, and the very long and slender tarsi, seem, however, to afford good ground for their separation; the curious foveolation of the pygidium and (in some cases) the propygidium must also be mentioned.

With regard to the habits of the genus Mr. Lewis says (*l. c.* p. 332):—"*Niponius* is entomophagous and essentially diurnal: but instead of following the *Platypi*, which bore diametrically into the timber, it seeks out *Scolyti* and *Tomici* which reside either in the bark or not far from the cambium. In fine weather, in June, at Kashiwagi, I have taken *Niponius*, in company with *Cyphagogus*, crawling over the bark of oaks in search of fresh burrows."

The family was first discovered in Japan, but species have since been found in India, and Mr. Lewis records an example of a new species from Borneo in the British Museum, from the Pascoe Collection. The average length appears to be from 4–5 mm., but one of the Indian species (*M. parvulus*, Lewis) is only 2 mm. long.

[Family 27. PLATYPSYLLIDÆ.]

Size small; structure, in many respects, quite abnormal; head large with a comb-like row of spines on its posterior margin; eyes wanting; mandibles rudimentary; maxillæ bilobed; mentum large and conspicuous, deeply divided behind into three lobes; antennæ received in grooves on the underside of the thorax, with the first joint long, the second enlarged, short, excavate and pubescent, and receiving in its socket a short oval knob consisting of seven or eight closely united joints; elytra much abbreviated, leaving six ventral segments of the abdomen visible from above; legs short and rather stout; tarsi 5-jointed; wings absent.

The single species forming this family is one of the most abnormal of all the Coleoptera. It was discovered in 1868 on a dead American Beaver in the Zoological Gardens of Rotterdam, and was at first believed to be a suctorial insect, related to the PULICIDÆ; it also shows some points of resemblance with the *Mallophaga*, or Biting Lice. Westwood considered it to form a separate order altogether, which he called Achreioptera, but it is certainly a beetle, though an anomalous one. The mandibles indeed are rudimentary, but the maxillæ are well developed and quite Coleopterous; its Coleopterous nature is also proved by its larva, which is elongate, moderately broad, narrower in front and behind, with the short cerci at the apex, which are a little longer than the stout anal appendage between them; it resembles certain of the Staphylinid larvæ and has the same kind of motion, but it is perhaps most closely related to the larvæ of the SILPHIDÆ.

Very little is known of the life-history of the insect, except that it has been found on the Beaver, alive and dead, in Europe and America. Whether it is carnivorous, feeding on other smaller parasitic insects on the Beaver, or whether it feeds chiefly on exudations from the skin or on the scales of the epithelium is not known; the rudimentary mandibles would seem to favour the latter view.

In its habits *Platypsyllus* is related to *Leptinus*. Leconte considers these genera closely related, through the formation of the mentum, but there is little in common between the trilobed mentum of the former, and the undivided, though certainly abnormal form of that organ in the latter.

The family is here included under the STAPHYLINOIDEA for convenience' sake, and because of its relation to the SILPHIDÆ; as the insect is apterous there is no venation to be considered.

Division 2. CLAVICORNIA.

In the third volume of his work (Die Käfer von Mitteleuropa, iii, p. 409) Ganglbauer assigns the following families to the CLAVICORNIA:—SPHÆRITIDÆ, OSTOMIDÆ (TROGOSITIDÆ), BYTURIDÆ, NITIDULIDÆ, PASSANDRIDÆ*, CUCUJIDÆ, EROTYLIDÆ, PHALACRIDÆ, THORICTIDÆ, DERODONTIDÆ, LATHRIDIIDÆ, MYCETOPHAGIDÆ, COLYDIIDÆ, ENDOMYCHIDÆ, and COCCINELLIDÆ; at the beginning of the fourth volume (Band I, p. 2) he further includes the families DERMESTIDÆ, BYRRHIDÆ, NOSODENDRIDÆ, GEORYSSIDÆ, DRYOPIDÆ (PARNIDÆ), HETEROCERIDÆ, and HYDROPHILIDÆ, but he only does this quite provisionally, and expresses his belief that the first of these groups at all events ought to come at the end of the DIVERSICORNIA, and therefore after the SERRICORNIA instead of before them. In this he is probably right, as it is more likely that the CLAVICORNIA are derived from the SERRICORNIA than the reverse; but the STAPHYLINOIDEA are so closely allied to the CLAVICORNIA that it seems better not to separate them widely in the present state of our knowledge. With regard to the order, and in many cases the constitution, of the families of this group, there is great difference of opinion, and it is best, perhaps, to leave any detailed discussion on these points to the specialists who will be taking up these sections. In the succeeding pages several other families are noticed as belonging to the CLAVICORNIA, which do not come within the scope of Ganglbauer's work.

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* Ganglbauer subsequently (*l. c.* iii, p. 565) includes this family under the CUCUJIDÆ.

Key to the Indian Families.

I. Maxillary palpi elongate, often much longer than the antennæ; antennæ with from six to nine joints, terminating in a club; tarsi five-jointed; habits aquatic or subaquatic .... **Hydrophilidæ**, p. 128.
II. Maxillary palpi not abnormally elongate.
  i. Antennæ subgeniculate .... **Synteliidæ**, p. 99.
  ii. Antennæ not geniculate.
    1. Antennæ very short, scarcely as long as the head, abnormal.
      A. Second joint of antennæ strongly developed, ear-shaped; habits aquatic or subaquatic .... **Dryopidæ (Parnidæ)**, p. 126.
      B. Antennæ with joints 5-11 forming a very short oblong club; habits fossorial .... **Heteroceridæ**, p. 130.
    2. Antennæ more or less elongate, clavate or filiform.
      A. Anterior coxæ with the trochanters of the front legs forming two plates which conceal the prosternum; tarsi short, four-jointed; habits subaquatic .... **Georyssidæ**, p. 126.
      B. Anterior coxæ normal.
        a. Tarsi long, five-jointed; claws strongly developed for clinging to stones in running water.... **Elmidæ**, p. 126[*].
        b. Tarsi and claws not strongly developed for clinging.
          *a**. Anterior coxæ with a free trochantin.
            a†. Posterior coxæ not grooved or sulcate.
              a‡. Tarsi five-jointed, with the first joint very short, and the fourth normal .... **Trogositidæ (Ostomidæ)**, p. 100.
              b‡. Tarsi five-jointed (rarely heteromerous), with the first joint not short and the fourth very small.. **Nitidulidæ**, p. 104.

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[*] We have, after some consideration, included the ELMIDÆ under the DRYOPIDÆ, but as the point is somewhat doubtful, we have left the table unaltered.

b†. Posterior coxæ grooved or sulcate for the reception of the femora.

a‡. Legs not strongly retractile; form usually oblong .... **Dermestidæ, p. 122.**

b‡. Legs very strongly retractile, capable of being drawn up entirely underneath the body; form oval or hemispherical, usually very convex.

* Head prominent; mentum large .... **Nosodendridæ, p. 124.**

** Head sunk in prothorax; mentum small ...... **Byrrhidæ, p. 123.**

*b**. Anterior coxæ without a free trochantin.

a†. Tarsi five-jointed, sometimes heteromerous in the male (very rarely four-jointed).

a‡. Epimera of mesosternum reaching the middle coxal cavities .... **Cucujidæ, p. 106.**

b‡. Epimera of mesosternum not reaching the middle coxal cavities.

* Tarsal claws simple; shape and size very variable.

† Tarsi pseudo-tetramerous, five-jointed, the fourth joint small, hidden in the emargination of the third joint (except in the Dacninæ *); shape and size very variable.............. **Erotylidæ, p. 108.**

†† Tarsi plainly five-jointed; small and inconspicuous insects, of more or less oblong form ...... **Cryptophagidæ, p. 110.**

** Tarsal claws toothed at base; form oval or elliptical and convex; small or very small and inconspicuous insects .... **Phalacridæ, p. 112.**

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* The Dacninæ may at once be distinguished from the Cryptophagidæ, except the Diphyllinæ and Xenoscelinæ, by having the anterior coxal cavities closed behind, and from the two last-mentioned subfamilies by having the hind coxæ widely separated (*v.* p. 108).

b†. Tarsi all three-jointed or apparently three-jointed.

a‡. Elytra entire, covering the abdomen; ventral segments of abdomen nearly equal in length. . **Lathridiidæ**, p. 113.

b‡. Elytra truncate, leaving the apex of the abdomen uncovered; first and fifth ventral segments longer than the others. . **Monotomidæ**, p. 107.

c†. Tarsi four-jointed, or with the front tarsi of the male three-jointed (very rarely all three-jointed).

a‡. Tarsi in male with 3–4–4 joints respectively, in female with 4–4–4 joints. **Mycetophagidæ**, p. 114.

b‡. Tarsi nearly always four-jointed in both sexes, with the third joint normal and free; abdomen with five ventral segments of which the first three or four are more or less connate .. **Colydiidæ**, p. 115.

c‡. Tarsi nearly always pseudo-trimerous, four-jointed, with the third joint usually very small, hidden in the emargination of the third; abdomen with five free ventral segments.

* Epimera of mesosternum obliquely quadrilateral; antennæ inserted between the eyes; anterior coxal cavities either closed or open behind; tarsal claws simple .... **Endomychidæ**, p. 117.

** Epimera of mesosternum irregularly triangular, with the apex directed to the front; antennæ as a rule inserted at the inner front margin of the eyes; anterior coxal cavities nearly always closed behind; claws, as a rule, appendiculate or toothed .. **Coccinellidæ**, p. 119.

Family 28. SYNTELIIDÆ.

Form elongate-oblong, subcylindrical, somewhat depressed; antennæ subgeniculate, with a broad compressed club; anterior coxal cavities closed behind; anterior coxæ transverse, conico-cylindrical, somewhat projecting, contiguous; pronotum free, not fitted to base of elytra; posterior coxæ strongly transverse, contiguous; elytra not completely covering abdomen; tarsi five-jointed, simple, with the first four joints equal; abdomen with five visible ventral segments and eight or nine dorsal, all corneous. Median loop of the wing veins much contracted.

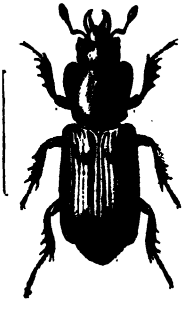

Fig. 47.
Syntelia indica.

The position of this family, which contains one genus and five or six species, has been much disputed. Westwood placed it in the TROGOSITIDÆ, but it is separated from this family by the structure of the antennæ and tarsi, the contiguous posterior coxæ, the exposed pygidium, the entirely corneous dorsal segments of the abdomen, the wing venation, etc.; it appears to be most closely allied to the HISTERIDÆ, with which it agrees in the structure of the antennæ and the corneous dorsal plates, but differs in the contiguous anterior coxæ, the contiguous and transverse posterior coxæ, and the different relations of the side-pieces of the meso- and meta-thorax. The wing venation is very like that of *Hister*, for although a median loop is present, yet it is very much contracted and situated high up towards the base of the wing, and the general venation is rather that of the STAPHYLINOIDEA than of the CLAVICORNIA.

Syntelia is also allied to the SILPHIDÆ, but differs in the form of the antennæ and mandibles, in the absence of trochantins to the front and middle coxæ, and in the corneous dorsal plates.

Its nearest ally, perhaps, is *Sphærites*, which Dr. Sharp regards as forming a subfamily of the SYNTELIIDÆ, but it is distinguished by the shape of the first joint of the antennæ, the more slender legs, the fact of the pronotum being closely adapted to the base of the elytra, the anterior coxal cavities open behind, and the entirely different facies; at the same time the wing venation is very similar. Mr. G. Lewis originally placed his aberrant genus *Niponius* under SYNTELIIDÆ, but afterwards transferred it to the HISTERIDÆ. Nothing appears to be known about the life-history of *Syntelia*. The species occur in very widely separated localities, in India, Eastern Asia, and Mexico; they have been found at sap running from trees.

[Family 29. SPHÆRITIDÆ.]

Antennæ short, with the first joint thickened, but not geniculate, eleven-jointed, with a large and compact three-jointed club; anterior coxal cavities open behind; pronotum fitting closely to elytra; elytra truncate at apex, leaving the apex of the abdomen exposed; anterior and posterior coxæ contiguous; middle coxæ rather widely separate; posterior coxæ transverse, with a short broad process; legs comparatively slender, tarsi five-jointed.

The single genus *Sphærites*, which forms this family, is very closely allied to the SYNTELIIDÆ, and in the venation of the wings it is very similar. In facies it resembles *Saprinus* or *Hister*, and like *Syntelia* appears to be closely related to the HISTERIDÆ. It is also nearly related to the SILPHIDÆ, with which it is often classed by authors, but differs in the wing venation, the formation of the anterior coxal cavities, etc.; in some points it approaches certain NITIDULIDÆ. The genus contains only one species, which is found in Northern and Central Europe and in the west of North America (Alaska, Sitkha, Vancouver's Island, and California).

Dr. Sharp considers the genus to form a tribe of the SYNTELIIDÆ, but, apart from all else, it differs entirely in habits from the species of *Syntelia*, the latter being only found at the sap of felled or wounded trees, while *Sphærites* occurs in decaying fungi, under excrement, in small carcases, snails, etc.

Family 30. TROGOSITIDÆ (OSTOMIDÆ).

Very closely allied to the Nitidulidæ, *and differing in the formation of the tarsi which have the first joint, and not the fourth, very small; they are five-jointed, but appear to be four-jointed; antennæ inserted under the side margin of the front, before the eyes, eleven-jointed, rarely ten-jointed, usually with a loose three-jointed (often laterally asymmetrical) club; maxillæ always bilobed; elytra entirely covering the abdomen; anterior and middle coxæ more or less separated; abdomen with five, rarely six, visible ventral segments.*

The members of this family vary very much in form, from the elongate and cylindrical *Nemosoma* to the convex and elliptical or almost hemispherical forms *Ostoma* (*Peltis*) and *Thymalus*. The most characteristic genera are *Temnochila* and *Tenebrioides* (*Trogosita*), both of which contain a considerable number of species. The total number of TROGOSITIDÆ hitherto described is about 400, but very few have been as yet recorded from India, and they are probably not numerous in that country as they seem to be chiefly attached to the New World. Grouvelle has recently recorded and described about seventeen species from the Indian region belonging to *Temnochila*, *Tenebrioides*, etc. In the Munich Catalogue one species of *Melambia*, three of *Trogosita*, and one of *Peltis* are mentioned, all but one being recorded from Ceylon.. The species of *Nemosoma*, *Temnochila*, and *Tenebrioides* mostly inhabit decayed trees; they are carnivorous and devour the larvæ of xylophagous insects. The members of the genus *Ostoma* and its allies are chiefly found in fungi on trees, and may also be carnivorous, but this is uncertain. The cosmopolitan *Tenebrioides mauritanica* is found in flour and corn and is said to do damage to the grains, but it has been proved that they also devour larvæ of other insects living in the corn, so that their action may be rather beneficial than hurtful.

The larva of *Temnochila cærulea*, which has been figured by Perris, is elongate and parallel-sided, with a very large head furnished with powerful jaws, and the thoracic segments plainly larger than the abdominal; the segments are furnished with larger or smaller corneous dorsal plates, and the sides with scanty bristles; the apex is terminated by two stout hook-like cerci with the points turned outwards.

The composition of the family has given rise to some controversy. It is quite plain that *Syntelia* and *Helota*, which have been included in it, must be regarded as quite distinct. The right position is evidently very near to the NITIDULIDÆ, from which the TROGOSITIDÆ only differ in the structure of the tarsi and in the fact that the maxillæ are always bilobed.

Lacordaire divides the family into four tribes as follows :—

I. Antennæ 10-jointed........................ **Egoliides.**
II. Antennæ 11-jointed (10-jointed in two species of *Nemosoma*).
  i. Internal lobe of the maxillæ simple.
    1. Eyes simple .... **Trogositides.**
    2. Eyes divided into two, at least in the males **Gymnochilides.**
  ii. Internal lobe of the maxillæ furnished with a corneous hook .. .. **Peltides.**

This division, however, is not very satisfactory, and the family may be divided into two subfamilies :—

I. Inner lobe of maxillæ rudimentary, or at least simple and without a terminal hook; form elongate or elongate oblong; elytra with narrowly margined sides and narrow epipleuræ . TROGOSITINÆ.
II. Inner lobe of maxillary palpi strongly developed and furnished with a strong hook; form narrower or broader, elliptical, convex; elytra with distinct broad margins and broad epipleuræ .... PELTINÆ.

[Family 31. HELOTIDÆ.]

Form elongate-oblong; head small, antennæ short, with a four-jointed club; labrum almost concealed; mentum transverse, anterior margin sinuate; anterior and middle coxal cavities closed, quite round, all the coxæ widely separated; abdomen with five visible ventral segments; disc of elytra with two raised waxy spots on each, one before and the other behind middle; tarsi with five distinct joints, the fifth being longer than the rest combined.

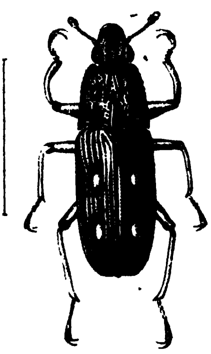

Fig. 48.—*Helota servillei.*

This family has usually been considered to belong to the **Erotylidæ**, but it comes nearer to the **Trogositidæ** in its tarsal structure; it is also closely related to *Ips* among the **Nitidulidæ**. The general form, the shape of the coxal cavities, and the characteristic waxy patches on the disc of the elytra will serve to distinguish it. The number of species at present known is about forty; these are confined to the Indo-Malay region and Japan, with the exception of one which has occurred in East Africa. Mr. Lewis has observed them feeding on the sap of trees. They have always been regarded as scarce insects, but species will almost certainly be found in the Indian region proper.

[Family 32. BYTURIDÆ.]

Antennæ inserted before the eyes, eleven-jointed, with a three-jointed club; coxæ narrowly separated; anterior coxal cavities closed behind; epimera of mesosternum reaching the middle coxal cavities; elytra entirely covering abdomen; tarsi five-jointed, with the fourth joint small, and with the second and third joints lobed beneath; claws toothed; abdomen with five free ventral segments.

This is a very doubtful family as regards position. Erichson classed it with the **Melyridæ**, Stephens with the **Engidæ**, Du Val with the **Telmatophilidæ**, Latreille and Kiesenwetter with the **Nitidulidæ**, and Redtenbacher, Lacordaire (who speaks of *Byturus* as "genre très embarrasant"), and recently Sharp, with the **Dermestidæ**. In my work on British Coleoptera (iii, p. 305) I have placed it as a separate family between the **Cucujidæ** and the **Cryptophagidæ**, near the tribe **Telmatophilina**, to which it is closely related by its tarsal structure.

Ganglbauer (*l. c.* iii, p. 437) also regards it as separate; but on the ground of the epimera reaching the middle coxal cavities and the free trochantins of the anterior coxæ, he considers it to be related to the TROGOSITIDÆ and NITIDULIDÆ, and assigns it a position between these families.

The family contains one genus, comprising three or four small obscure pubescent species which are found in flowers, especially of raspberries, to which the larvæ sometimes do great damage; two are found in Europe and two in North America.

The larva is cylindrical, with scanty long hairs at the sides, depressed in front, with thin corneous plates on the abdominal segments; the abdomen is terminated by two short and sharp cerci, which are curved outwards, and an anal segment consisting of a cylindrical tubercle which is retractile and assists locomotion. The pupa is very pilose.

Family 33. NITIDULIDÆ.

Form, size, and characters very variable; mostly small insects with the last one or two segments of the abdomen exposed, but occasionally with the greater part of the abdomen uncovered, and the elytra very short, while in other cases the whole of the abdomen is concealed; maxillæ usually with one lobe only (but bilobed in the BRACHYPTERINÆ*); antennæ inserted under the margin of the front, eleven-jointed (in* Rhizophagus *apparently ten-jointed), terminated by a round or oval club); prosternum variable; mesosternum separating the middle coxæ, side pieces with the epimera large, extending to the coxæ; abdomen composed of five free ventral segments, the first a little the longest; tarsi with the number of joints variable, usually five-jointed, with the fourth joint very small; anterior coxæ transverse and separated, not prominent; intermediate and posterior pairs transverse, flat and distant, the latter extending almost to the margin of the body.*

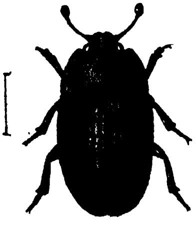

Fig. 49.—*Lordites picta.*

This is a large and very interesting family containing, so far as at present known, about 1500 species, which are extremely variable in size, shape, facies, structure and habits. Several of the genera are well known for the difficulty attending the discrimination of their numerous species; among these may specially be mentioned *Meligethes* and *Camptodes*; the difficulties, however, to a great extent vanish on a closer examination of the characters. Several of the genera are brachypterous and closely resemble STAPHYLINIDÆ, for which they might easily be mistaken; among these are *Halepopeplus*, *Cillæus*, *Orthogramma*, *Ithyphenes*, and *Adocimus*; in fact they can only be distinguished superficially by the shape of the antennæ and the smaller number of visible segments. One or two of the genera, such as *Calonecrus* and *Ctilodes*, are larger and very peculiar in structure and facies.

The habits of the NITIDULIDÆ are very various. One large group lives in flowers, while another is found at sap or at the exudations of trees infested by boring insects; others again are found in fungi, others in decaying animal substances, or under bones, while the cosmopolitan genus *Carpophilus* is found among grain, or dry preserved fruits; the peculiar genus *Amphotis* is attached to ants' nests.

The classification of the NITIDULIDÆ has given rise to a good deal of dispute, not so much on its general points, as with regard to the inclusion or exclusion of two or three subfamilies. The RHIZOPHAGINÆ and CYBOCEPHALINÆ have, in the past, been removed from the group, but they have been rightly restored to it, and Horn is also right in including the SMICRIPINÆ. In the latter subfamily, however, as Ganglbauer has pointed out, the tarsi are 4-jointed, with the third joint hard to distinguish, and not 3-jointed as given by Horn and Leconte in their table (Classif. Col. North America, p. 149); with one or two alterations this table may with advantage be adopted as follows:—

I. Antennæ 11-jointed, terminated by a plainly 3-jointed club; tarsi isomerous, similar in the two sexes.
  i. Tarsi 5-jointed.
    1. Labrum free, more or less visible.
      A. Maxillæ with two lobes; antennæ with a feeble club; abdomen with two or more segments exposed . . BRACHYPTERINÆ.
      B. Maxillæ with one lobe; antennæ with a distinct club.
        a. Pronotum not margined at base; head horizontal.
          *a**. Abdomen with two segments exposed.................. CARPOPHILINÆ.
          *b**. Abdomen covered or with only part of the pygidium exposed.................. NITIDULINÆ.
        b. Pronotum margined at base, covering the base of the elytra; head more or less deflexed.... CYCHRAMINÆ.
    2. Labrum connate with the epistoma; form elongate-oblong or oblong; stridulating organs as a rule present. IPINÆ.
  ii. Tarsi plainly 4-jointed; pronotum margined at the base and covering the base of the elytra (as in CYCHRAMINÆ); body spherical and retractile........ CYBOCEPHALINÆ.

iii. Tarsi apparently 3-jointed, but really 4-jointed, with the third joint very small; body elongate	Smicripinæ.
II. Antennæ apparently 10-jointed with a 1-jointed club*	Rhizophaginæ.

Dr. Sharp is of opinion that the Rhizophaginæ should be brought under the Cucujidæ, and that certain insects now placed under Monotomidæ should also be regarded as belonging to the Cucujidæ and assigned a position near *Rhizophagus* (Biol. Centr.-Amer., Coleopt. ii, pt. i, p. 500).

The position of the Nitidulidæ, as a whole, can hardly be regarded as settled, but they certainly come very near to the Trogositidæ, and the position assigned to them by Sharp, between the Phalacridæ and the last named family, is as good as any that can be adopted in the present state of our knowledge, though in some points they are connected with the Histeridæ. Several of the larvæ have been described by Perris and others. They do not present any striking peculiarities, being elongate and more or less tapering; the abdominal segments often have tubercles on the margins, and bristles or small tubercles on the back; the last segment is usually terminated with a pair of hooks, and in some cases (e.g. *Soronia*) there are two additional hooks on the back of the segment; the antennæ are usually 4-jointed, but in some cases they appear to be 3- or even 2-jointed; the legs are short and terminated by a single claw. The small larvæ of some of the flower-haunting species, such as *Meligethes*, occasionally do much damage to cultivated Cruciferæ, especially rape and mustard.

The family is evidently numerous in India, but has not been worked until quite recently; more species have been described from Ceylon than from any other part of the region. The cosmopolitan genus *Carpophilus* is well represented (23 species occurring in India), and several species of *Nitidula*, *Meligethes*, *Epuræa*, and *Cybocephalus* have been described; a few genera are peculiar to India and Ceylon, such as *Nitidulopsis*, *Cametis*, *Idocoloastus*, and *Idæthina*. Among others, the following may be mentioned as represented: *Brachypeplus*, *Orthogramma*, *Pria*, *Pocadius*. *Amphicrossus*, *Cryptarcha*, *Cyllodes*, *Omosita*, and *Lasiodactylus*. Grouvelle (Ann. Soc. Ent. France, vol. lxxvii, 1908, pp. 325–397) notices or describes 150 species from the Indian region.

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* The eleventh joint may be considered as merged in the tenth, but, as I have said before (Brit. Col. iii, p. 263), I have soaked a specimen for a long time in caustic potash and mounted it in Canada balsam and examined it under a compound microscope without discovering any real suture.

Family 34. CUCUJIDÆ.

Antennæ inserted under the side margin of the forehead, eleven-jointed; maxillæ with two lobes; anterior and middle coxæ small and globular, hind coxæ transverse; metasternum large; elytra rounded at the apex and usually covering the abdomen; tarsi all five-jointed, or in male 5–5–4, or rarely all four-jointed; form, as a rule, flat and much depressed.

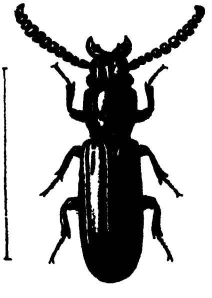

Fig. 50.—*Hectarthrum depressum.*

The insects forming this group are variable in their habitat and habits; the majority live under bark and in the borings of xylophagous insects, and are apparently carnivorous in the larval state; others are found among grain, in dried fruits, tobacco, etc. (*Silvanus* and species of *Læmophlœus*), while a few species are myrmecophilous. Some 450 species are known, of which about 75 are Indian: *Brontes*, *Læmophlœus*, *Psammœcus*, *Cucujus*, *Nausibius*, *Hectarthrum*, and *Prostomis* are scantily represented, while *Euryplatus* and *Ochrosanis* are peculiar to the region *.

The composition of the family is at present unsettled, and it is hard to determine its true position. Ganglbauer places it between the NITIDULIDÆ and EROTYLIDÆ, while Sharp follows Leconte and Horn in placing it between the RHYSODIDÆ and CRYPTOPHAGIDÆ (Cambridge Natural History, vi, p. 234, 1899), although in the 'Biologia Centrali-Americana' (Coleopt. ii, pt. 1, 1899, p. 563) he precedes the last named family by the MONOTOMIDÆ. This latter family is included by Ganglbauer under the CUCUJIDÆ, and the members of the genus *Europs* are very closely allied to them, but it is best perhaps to retain them as separate for the present. The HELOTIDÆ, which have also been included by some authors, appear to be very distinct.

The larvæ of several genera have been described, but, as might be expected, they differ very much in structure, some being very flat, like the perfect insects, while others are more convex and cylindrical; the eighth abdominal segment is sometimes (*Pediacus*) much elongated; the anal process and cerci are much developed in some species (*Brontes*, etc.), while in *Silvanus* there are no processes of any kind, the last segment being quite simple.

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* Grouvelle (Ann. Soc. Ent. France, lxxvii, 1908, pp. 452–494) notices about seventy-five species from India, twenty-five of these belonging to *Læmophlœus*, and twelve to *Psammœcus*.

The following table will show the chief divisions:—

I. Maxillæ covered by corneous plates.	
i. Anterior coxal cavities open behind	Passandrinæ.
ii. Anterior coxal cavities closed behind.	
1. Tarsi 5-jointed	Ancistriinæ.
2. Tarsi 4-jointed	Prostominæ.
II. Maxillæ exposed.	
i. Anterior coxal cavities open behind	Cucujinæ.
ii. Anterior coxal cavities closed behind.	
1. Tarsi not lobed beneath	Silvaninæ.
2. Tarsi with the third joint lobed.	
A. Tarsi with the fourth joint not smaller than third	Hemipeplinæ.
B. Tarsi with the fourth joint very small	Telephaninæ.

The corneous plates covering the maxillæ in the first section are very peculiar, and the species possessing them were considered to belong to a separate family, Passandridæ, until the close affinity between the larvæ of *Prostomis* and those of certain of the Cucujidæ was discovered.

Family 35. MONOTOMIDÆ.

Antennæ inserted under the sides of the forehead, ten-jointed, or obsoletely eleven-jointed, with the club solid or obsoletely two-jointed; maxillæ free; anterior coxæ globular, their cavities broadly closed behind; epimera of mesosternum reaching the middle coxal cavities: abdomen with five free ventral segments, of which the first and fifth are longer; males with a small extra ventral segment; tarsi five-jointed, but apparently three-jointed; pygidium exposed.

About 100 species are included in the family, which are very widely distributed. They are, as a rule, very small insects, which occur under bark, among rubbish, etc., and a few are myrmecophilous. A considerable number of new species have been found in Central America by Mr. Champion, mostly belonging to the genera *Europs* and *Bactridium*, which are very closely related to the Cucujidæ. The family is also closely allied through *Aneurops* to the Rhizophaginæ among the Nitidulidæ. By some authors the Monotomidæ have been included under the Lathridiidæ, probably on account of their small size, general appearance, and apparently 3-jointed tarsi, but they are quite distinct *.

One species of *Monotoma*, one of *Monotomopsis*, and two of *Europs* have been described from India.

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* The number of tarsal joints in the Monotomidæ has been disputed: Horn gives them as three, Leconte as five; Ganglbauer (*l. c.* p. 571) agrees with Leconte, but adds that there are at any rate indubitably five in the genus *Monotoma*.

Family 36. EROTYLIDÆ.

Form and size very variable; antennæ inserted in front of or between the eyes, eleven-jointed, with a three- or four-jointed club; anterior and intermediate coxæ globose, not prominent, posterior pair transverse; epimera of mesosternum not reaching the middle coxal cavities; mesosternum moderate, metasternum rather long; elytra entirely covering abdomen; abdomen with five free segments; tarsi distinctly five-jointed (Dacninæ) *or apparently four-jointed, the fourth joint being minute and hidden in the lobe of the third joint* (Erotylinæ *and* Languriinæ).

The position and composition of this family have been very much disputed. The formation of the tarsi in the greater number of its members has caused it to be placed by many authors with the Chrysomelidæ, with which however it has very little real relation; among other things the loop of the median vein of the wings, which is one of the chief characteristics of the Clavicornia group, is very distinct in *Erotylus*.

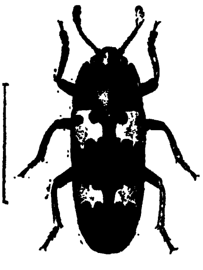

Fig. 51.—*Episcapha indica.*

The relation of this family to the Cryptophagidæ through the Dacninæ has long been recognized, and there is much to be said for placing the families together, some authors having actually adopted this course. Sharp (Biol. Centr.-Amer., Col. ii, pt. 1, p. 579) practically says that he would have done so if the Erotylidæ of Central America had not previously been dealt with by Gorham; and Ganglbauer (Die Käfer von Mittel Europa, iii, p. 633) includes the Cryptophagidæ under the Erotylidæ, of which he forms three subfamilies as follows:—

I. Anterior coxal cavities entirely closed behind	Erotylinæ.
II. Anterior coxal cavities open behind or at least not entirely closed.	
i. Antennæ inserted before the eyes under the side margins of the forehead	Cryptophaginæ.
ii. Antennæ inserted between the eyes, the space of forehead between them forming an angled or rounded process, which, in the middle, slopes more or less plainly towards the clypeus	Atomariinæ.

Lacordaire observes (Gen. Coléopt. ii, p. 421) that the inclusion of the Cryptophagidæ under the Erotylidæ is all very well ("il n'y a rien qui blesse le sentiment des analogies") so far as

the limited European fauna is concerned, but it is when we come to deal with the exotic species, which must necessarily include the enormous number of tropical EROTYLIDÆ, that the difficulty arises, for these by their size, general form, bright and varied coloration, Chrysomelid-like tarsi, etc., are completely in contrast with the CRYPTOPHAGIDÆ. We believe, however, that even as regards the European species the coalition of the two families is wrong; as they are constituted, the DACNINÆ with their distinctly 5-jointed tarsi, etc., certainly possess the essential characters of the CRYPTOPHAGIDÆ, but the mass of the EROTYLINÆ with their deeply-lobed third tarsal joint and pseudo-tetramerous tarsi are widely separated from them. Some authors, such as Latreille and Dejean, appear to have removed *Dacne* from the EROTYLIDÆ, which is a logical course to take, and if the MYCETÆINÆ (as Sharp believes) are to be separated from the ENDOMYCHIDÆ, the DACNINÆ ought also to be regarded as distinct from the EROTYLIDÆ, as the difference in the tarsal characters is precisely the same in both cases (except that the number of tarsal joints is five in one family and four in the other).

The LANGURIIDÆ cannot be regarded as anything but a subfamily of the EROTYLIDÆ, although they have been treated by a large number of writers as a distinct family. They are distinguished by their elongate shape and the fact that the anterior coxal cavities are open behind; they have also been separated on the character of the indistinctness of the separation of the metasternal epimera and episterna; this, however, is incorrect, for as Gorham has pointed out (Proc. Zool. Soc. Lond. 1887, p. 358) these are "quite apparent, though not to be easily seen, and only as small points, until the elytra are removed and the side exposed." Many of them possess well-developed stridulating organs on the head. The HELOTIDÆ, which have been included by Chapuis and others, must certainly be referred to a separate family, and are more closely allied to the TROGOSITIDÆ than to the EROTYLIDÆ.

The EROTYLIDÆ, as at present known, contain upwards of 2000 species; they are scarce and insignificant for the most part in temperate countries, but in the tropics they are plentiful and widely distributed, many of them being very conspicuous and highly coloured insects. The EROTYLINÆ live as a rule in fungoid growths on and about timber, and are therefore found chiefly in forests; the LANGURIINÆ, however, are more like the CHRYSOMELIDÆ in their habits, and frequent brushwood or various low plants. The larvæ of some species at times do considerable damage; *Languria mozardi*, for instance, in the larval state, as pointed out by Professor Comstock (Ann. Rep. Dept. Agric. Washington, 1879), feeds inside the stems of red-clover, and injures the crop. The full-grown larva is a long yellow grub, about half an inch long, with six prominent legs, a distinct anal appendage or pseudopod, and two stiff slightly upward curved spines on the last abdominal segment. The larvæ of the EROTYLINÆ appear to be of broader form, with very short legs and antennæ, the last abdominal segment being either simple or furnished with short horny appendages; an anal appendage or pseudopod for progression is usually, but apparently not always, present.

The EROTYLINÆ are well represented in India by large and fine forms (*Megalodacne*, *Triplatoma*, etc.); the LANGURIINÆ are also plentiful, and several of the finest forms (*Fatua*, *Doubledaya*, *Callilanguria*, etc.) occur in the region.

As here constituted the family may be divided as follows:—

I. Tarsi distinctly 5-jointed, with the third joint simple and the fourth distinct, though shorter than the preceding .... DACNINÆ.
II. Tarsi 5-jointed, but apparently 4-jointed (the fourth joint being very small and more or less hidden between the lobes of the bilobed third joint).
  i. Anterior coxal cavities closed behind .... EROTYLINÆ.
  ii. Anterior coxal cavities open behind; form usually elongate .... LANGURIINÆ.

Family 37. CRYPTOPHAGIDÆ.

Small insects; antennæ inserted in front of the eyes under the side margins of the forehead, eleven-jointed, terminating in a three-jointed, rarely two-jointed club; pronotum with the sides margined or denticulate; anterior and middle coxæ small and not prominent; elytra covering the abdomen; upper surface more or less setose or pubescent, often strongly so; abdomen with five visible ventral segments, the first being the longest; tarsi five-jointed, sometimes heteromerous in the males.

In the Munich Catalogue just 300 species are enumerated as belonging to the family; in the 'Biologia Centrali-Americana' Sharp describes 103 species, and the number now known must be upwards of 500; they are found in both tropical and temperate countries, the genus *Cryptophagus* being more characteristic of the latter. *Diphyllus* is now included in the family, although it might, as Sharp has pointed out, be regarded as the type of a separate family by itself; it cannot be included under the MYCETOPHAGIDÆ, nor does it bear a very close relation to the rest of the CRYPTOPHAGIDÆ: we have, however, followed Ganglbauer in retaining it under this family, rather than multiply small families. The close relations that exist between the CRYTOPHAGIDÆ and EROTYLIDÆ are discussed under the latter.

The members of the family vary in habitat. The DIPHYLLINÆ are found in fungi or under bark; the TELMATOPHILINÆ in the spathes of water-plants, under flowers, etc.; among the CRYPTOPHAGINÆ the genus *Antherophagus* is found on flowers, but the larva occurs in bees' nests; the species of *Crytophagus* and

Atomaria occur in all sorts of localities, in fungi, among mouldy grain, in decaying straw and vegetable refuse, on herbage, etc. Some of the larvæ of the former genus are found in wasps' nests, and one or two members of the genus *Atomaria* occur in the runs of ants' nests. The larva of *Cryptophagus dentatus* has been described and figured by Perris; it is long, but somewhat robust, with the prothoracic segment longer than the succeeding ones and with long hairs at the sides; the last segment is rather long, broad, and emarginate at the apex, the sides being produced into a short point; there are, however, no definite appendages.

The family, as known, is very poorly represented in India, but in all probability a considerable number of species exist in the region. A species of *Cryptophagus* has been found in Burma, and a single genus *Glisonotha* has been described from Ceylon.

The subfamilies may be distinguished as follows:—

I. Anterior coxal cavities closed behind.
  i. Form oblong or oval, somewhat convex; upper surface pubescent................ DIPHYLLINÆ.
  ii. Form narrow, elongate and depressed; upper surface bare.......................... XENOSCELINÆ.
II. Anterior coxal cavities open behind (except in *Calocryptus*, Sharp).
  i. Tarsi with the third and sometimes also the second joint lobed beneath .... TELMATOPHILINÆ.
  ii. Tarsi simple, without lobes.
    1. Antennæ inserted at the sides of the forehead, distant; pronotum with the sides usually denticulate; upper surface more or less setose .... CRYPTOPHAGINÆ.
    2. Antennæ inserted on the forehead between the eyes, approximate; pronotum with the sides not denticulate; upper surface not setose .... ATOMARIINÆ.

Ganglbauer (*l. c.* iii, p. 635) classes the DIPHYLLINÆ and XEROSCELINÆ under the EROTYLIDÆ.

[Family 38. CATOPROCHOTIDÆ.]

Minute insects; antennæ very short, inserted under the side margins of the forehead, eleven-jointed, compact, with short closely-fitting joints, but without trace of a club; anterior coxæ separated by a parallel-sided prosternal process, cavities closed behind; intermediate and posterior coxæ very widely separated; pronotum as broad at base as elytra, and forming a continuous outline with the latter; elytra not quite covering abdomen; antennæ with five free visible segments; tarsi five-jointed.

This family contains a few very small (3 mm.) insects from Turkestan. They are chiefly distinguished by the formation of the antennæ and the very distant intermediate and posterior coxæ; in appearance they are something like the CORYLOPHIDÆ, but are not so round; they appear to be allied to the CRYTOPHAGIDÆ and SILPHIDÆ, but can hardly be classed with either. It is quite possible that representatives of the family may be found in Northern India.

Family 39. PHALACRIDÆ.

Very small, compact, convex, smooth and shining insects; elytra entirely covering the abdomen; head sunk in the pronotum; antennæ inserted under the elevated margins of the front, eleven-jointed, with the apical joints forming a more or less distinct club; anterior coxæ globular; legs short and rather stout; tarsi five-jointed, with the fourth joint often almost obsolete.

The number of species at present described amounts to about 300. They are all small insects, which live in flowers, especially in fruit-blossom and the heads of various Compositæ; they appear to bore down the stems of the latter and to pupate in earthen cocoons. The larva of *Olibrus affinis* has been described and figured by Laboulbène; the head is much narrower than the pronotum, which is furnished with two dorsal plates, and there is a rather broad anal process, but no cerci. In the larva of *O. bicolor*, as figured by Heeger, there are two rather stout, short cerci and no anal appendage.

Phalacrus and *Olibrus* are well represented in India and Ceylon, and the genus *Augasmus*, Mots., appears to be confined to the Indian region.

[Family 40. THORICTIDÆ.]

Minute insects (the largest scarcely exceeding 2 mm.); eyes very small or rudimentary; antennæ short and thick, eleven-jointed, with an apparently solid, but really three-jointed, club; maxillæ bilobed; scutellum not visible; elytra connate at the suture, completely covering the abdomen; anterior coxal cavities open behind; metasternum very short; legs short and stout, tarsi five-jointed; abdomen with five free visible ventral segments.

This family comprises two genera, *Thorictus* and *Thorictodes*, which are almost entirely confined to the Mediterranean region. The genus *Thorictus* contains about forty species, which are associated with ants, and are so intimately connected with them that they may be often found hooked on to the scape of the antennæ of individual ants, which carry them about with them without apparently feeling much inconvenience. An illustration of this (after Wasmann) is given by Ganglbauer (Col. Mitt. Eur. iii, p. 763, fig. 40), in which *Thorictus foreli* is represented clinging tightly to the antenna of *Myrmecocystus megalocola*, with its antennæ and legs tucked tightly under its body. As in the PAUSSIDÆ and other ants'-nest beetles, the THORICTIDÆ are furnished with secretory tufts of golden hair, and it is very probable that, as Wasmann thinks, the position of the beetle on the antennæ enables the ant to reach these patches, which are in some cases situated on the under surface of the body, and in others at the posterior angles of the prosternum. The greater number appear to be associated with *Myrmecocystus*, but some occur with *Aphænogaster*, *Pheidole*, and *Tetramorium*.

[Family 41. DERODONTIDÆ.]

Small, coarsely punctured insects; antennæ inserted before the eyes, eleven-jointed, almost filiform, joints nine to eleven somewhat thicker than the rest; eyes prominent; anterior coxæ transverse, prominent and contiguous, the cavities closed behind, confluent; posterior coxæ transverse and slightly separated; elytra entirely covering abdomen; legs rather slender; tarsi five-jointed, simple; abdomen with five free and almost equal ventral segments.

This is a very small family of doubtful position; it contains about half a dozen species belonging to two genera, *Derodontus* and *Peltastica*, the former being oblong with a round thorax, which is strongly toothed at the sides, and the latter oval, resembling a very small *Peltis*. They occur in Europe, Japan, and North America, and nothing is known as to the larvæ or pupæ or their life-history. Sharp considers them to be scarcely distinct from the CLERIDÆ; Leconte and Horn place them between the LATHRIDIIDÆ and BYRRHIDÆ, but consider that in the form of the coxæ they approximate to the families following the ELATERIDÆ; while Ganglbauer assigns them a position between the THORICTIDÆ and LATHRIDIIDÆ.

Family 42. LATHRIDIIDÆ.

Minute insects, pubescent or glabrous, with the pronotum, as a rule, considerably narrower at the base than elytra, rarely ovate; elytra often strongly punctured, costate or nodulose; antennæ inserted in front of the eyes under the anterior angles or at the side margins *of the forehead; anterior coxæ globular or conical, more or less prominent, posterior coxæ transverse, separated; tarsi always three-jointed; abdomen with five or six free ventral segments.*

About 600 to 700 species of this family are known, hardly any of which are more than 2 m.m. in length. They are found in moss, faggots and decaying wood, fungi (especially when somewhat dry and shrivelled or powdery), among dried plants in collections, and in all sorts of dry vegetable rubbish; some species are found in dried carcases and a few are myrmecophilous.

The larvæ are soft and thin-skinned, elongate-oval or more or less elliptical, with the body clothed with longer or shorter hairs; they are composed of twelve segments and terminate in a quadrate appendage or pseudopod, which helps their progression, the legs being short. The pupa of *Lathridius minutus* is very peculiar by reason of the large and abruptly clavate pin-shaped hairs at the sides.

The Monotomidæ have often been wrongly included under the Lathridiidæ, and several genera, such as *Langelandia*, *Myrmecoxenus*, and *Anommatus*, which have been referred to it by various authors, have now been rightly placed under other families. *Holoparamecus*, *Lathridius*, and *Corticaria* are all represented in the Indian fauna. *Erotylathris* has been described from Ceylon, and *Tocalium* (with two species) from India.

The family may be divided as follows:—

I. Antennæ with the three or four last joints of the antennæ separately thickened, spindle-shaped, and set with long curved hairs .... DASYCERINÆ.
II. Antennæ without long hairs at apex.
  i. Anterior coxal cavities closed behind.
    1. Anterior coxæ separate; head longer before the eyes; elytra often carinate .... LATHRIDIINÆ.
    2. Anterior coxæ contiguous; head shorter before the eyes; elytra never carinate.. CORTICARIINÆ.
  ii. Anterior coxal cavities open behind ...... HOLOPARAMECINÆ.

Family 43. MYCETOPHAGIDÆ.

Antennæ inserted under the side margins of the forehead in front of the eyes, eleven-jointed, with the apical joints gradually thickened or forming a club; head small and short; anterior coxal cavities open behind; all the coxæ narrowly separated, anterior pair oval and prominent; legs slender, tarsi four-jointed, except the anterior pair in the male which are three-jointed; abdomen with five free and equal visible ventral segments.

This family, as at present constituted, is a small and unimportant one, and only about 100 species are known, very few having been recorded from India. They are related to the Cryptophagidæ and Lathridiidæ, and appear also to have some affinities towards the DERMESTIDÆ. Many of the species of the genus *Mycetophagus* are somewhat brightly coloured insects; they live in fungi on old wood for the most part, and are very active when disturbed; the genus *Typhæa* is found in mouldy hay, etc.

The larvæ are linear and elongate with very scanty long hairs at the sides of the segments, and there is nothing remarkable about them; the last segment terminates in two hooked processes, and the anal process is only visible on close examination.

Now that several discordant elements, such as *Byturus*, *Diphyllus*, and *Mycetæa*, have been removed from the family, it is fairly homogeneous and has been regarded as consisting of one subfamily. Ganglbauer, however (*l. c.* p. 823), has removed Reitter's subfamily ESARCINÆ (founded on the European genus *Esarcus*, Reiche) from the COLYDIIDÆ to the MYCETOPHAGIDÆ, as suggested by Seidlitz (D. E. Z. 1889, p. 147), and he is probably right in so doing.

Family 44. COLYDIIDÆ.

Form variable but mostly elongate and cylindrical; antennæ ten- or eleven-jointed, rarely eight-jointed, as a rule terminated by a distinct club, but sometimes gradually thickened; anterior coxal cavities almost always closed behind; mesosternum small; metasternum large; elytra never truncate, always covering the abdomen; tarsi simple, all four-jointed, very occasionally three-jointed (DISCOLOMINÆ)*; abdomen with five visible ventral segments, the anterior ones more or less connate.*

The members of this family are usually of an elongate and more or less cylindrical form, but exceptions occur as in the genera *Endophlœus*, *Cacotarphius*, *Acropis*, etc. They may be known for the most part by the small globular anterior and middle coxæ and the 4-jointed simple tarsi. They are found under bark of trees, on old stumps, in fungi and occasionally (*Langelandia*) underground.

Dr. Sharp remarks that the family is of interest, "owing to the great diversity of form, to the extraordinary sculpture and clothing exhibited by many of its members, and to the fact that most of its members are attached to the primitive forests and disappear entirely when these are destroyed. New Zealand has produced the greatest number of forms and the forests of Teneriffe are rich in the genus *Tarphius*."

The larvæ of *Ditoma crenata*, *Aulonium sulcatum*, and others are well known; they are elongate and parallel-sided with the segments not differing much in length throughout, and terminating in two short horny processes, which are characteristic of the Colydiid larvæ; the head is somewhat narrow, subquadrate, and the legs are short with claw-like tarsi.

About 600 species are at present known, many of which are insects of extreme rarity. Very few species have until recently been recorded from the Indian region, the greater part of these being from Ceylon; but Grouvelle (Ann. Soc. Ent. France, 1908, pp. 397–495) has recently added a considerable number, and we now have about thirty genera and over one hundred species: the following genera are among those represented:—*Coxelus*, *Tarphiosoma*, *Tarphius*, *Ditoma*, *Teredus*, *Colobicus*, *Meryx*, *Cicones*, *Sosylus*, *Cerylon*, *Bothrideres*, *Aulonosoma*, *Murmidius*, etc.

The classification of the COLYDIIDÆ has hitherto been in a very unsatisfactory state, partly owing to the rarity of the species, and partly to the fact that Erichson, who first separated them off as a family (Naturg. Ins. Deutsch. iii), tabulated them in a confused and unsatisfactory fashion. In the 'Biologia Centr.-Americana' (Coleopt. ii, p. 443 *et seqq.*), Dr. Sharp has gone more thoroughly into the group, and as his work is not very easy of access, it may perhaps be of advantage to quote his tables; at the same time it must be remembered that some of the groups run one into the other, and that the SYNCHITINÆ, which comprise the larger part of the COLYDIIDÆ, will probably, with extended knowledge, have to be further subdivided.

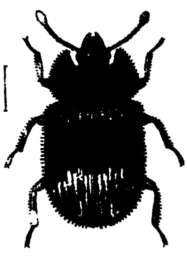

Fig. 52.—*Tarphiosoma fasciatum.*

I. Antennæ inserted at the sides of the head under the edge of the epistome, by which, however, the basal joint is but little concealed.	
i. Hind coxæ approximate; prosternum feebly ciliate behind	NEMATIDIINÆ.
ii. Hind coxæ approximate; prosternum with membranous border	GEMPYLODINÆ.
iii. Hind coxæ widely separated	PYCNOMERINÆ.
II. Antennæ inserted at the sides of the head; the basal joint placed under the edge of the epistome, by which it is more or less completely concealed from above.	
i. Antennæ densely clothed with scales or hairs, broad, not distinctly clavate	RHAGODERINÆ.
ii. Antennæ clavate, inserted near the eyes; basal joint of tarsus scarcely longer than the second; anterior coxal cavities usually open .	SYNCHITINÆ.
iii. Antennæ clavate, inserted near the eyes; basal joint of tarsus much longer than the second; anterior coxal cavities closed; tibiæ a little thicker at the tip	COLYDIINÆ.
iv. Antennæ clavate; hind coxæ more or less widely separated, the process between them usually truncate; flanks of prosternum more or less hollow for protection of the antennal club in repose	TARPHIINÆ.
v. Antennæ clavate, inserted far from the large, finely facetted eyes	ACROPINÆ.

III. Antennæ less widely separated from one another; basal joint exposed even in the state of retraction.
  i. Tarsi 4-jointed; terminal joint of maxillary palpi not minute; second joint of antennæ inserted more or less distinctly at the back of the first joint.
    1. Front coxæ approximate .... DERETAPHRINÆ.
    2. Front coxæ distant .... BOTHRIDERINÆ.
  ii. Tarsi 4-jointed; terminal joint of maxillary palpus minute, aciculate.
    1. Prosternum entire in front .... CERYLINÆ.
    2. Prosternum separated from flanks by a deep fissure .... LAPETHINÆ.
  iii. Tarsi 3-jointed; visible portion of hind coxa minute, globular, widely separated from the side-piece .... DISCOLOMINÆ.

[Family 45. ADIMERIDÆ.]

Minute insects with the first joint of the tarsi very broadly dilated and the last joint elongate, apparently two-jointed, but with two minute joints at the base of the terminal joint, which are almost concealed in the cavity of the first joint; other characters those of the COLYDIIDÆ.

This family contains one genus and three species from Central America and Brazil; nothing is known of their life-history; the tarsal structure differs from that of any other known Coleoptera.

Family 46. ENDOMYCHIDÆ.

Variable in size and general appearance; antennæ inserted between the eyes at the front angle or at the side margin of the forehead, usually eleven-jointed, rarely eight- to ten-jointed, or even four-jointed, with a large club; anterior coxal cavities open behind; anterior and intermediate coxæ globular or somewhat transverse, posterior coxæ transverse, widely separated; tarsi crypto-tetramerous or pseudo-trimerous, with the third joint very small and concealed in the bilobed second joint, or plainly four-jointed, or rarely three-jointed; abdomen with five free ventral segments, or with a sixth visible, the first the longest; epimera of mesosternum obliquely quadrilateral.

This family contains about 500 to 600 species, many of them of brilliant colours and elegant appearance, which are found for the most part in tropical forests and occur chiefly in fungoid growths on timber. They are well represented in Asia, especially in the Indo-Malay region, and several interesting and conspicuous species are characteristic of the Indian fauna, among which may be mentioned *Eucteanus* (from the Himalayas), *Amphisternus*, *Ancylopus*, *Eumorphus*, *Stenotarsus*, and *Trochoides*; the European genus *Lycoperdina* is also represented.

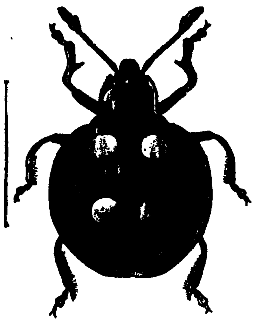

Fig. 53.—*Eumorphus marginatus.*

Dr. Sharp separates the Mycetæinæ as a distinct family, but if this is adopted, the Daoninæ should also be removed from the Erotylidæ; we have therefore retained them. The European *Mycetæa hirta* is a small *Cryptophagus*-like insect that is found in cellars, about beer-drippings, and in fungi.

In shape and size the members of the family vary from small, almost hemispherical, insects of not more than one millimetre in length to some of the most conspicuous and striking species that are to be found among the moderate-sized Coleoptera.

The larvæ of a few species have been described; they are broader and more ovate than in the allied families. The larva of *Endomychus coccineus* seems to bear a strong analogy to that of certain Silphidæ. Bates has described those of *Corynomalus discoideus* and *Stenotarsus obtusus*; the former is oval and convex, fleshy below but with the upper side rough and more or less granulose and squamose; the sides of the thoracic segments are dilated and foliaceous; the colour is sooty black above with a yellow margin, and with a double row of velvety black oval spots surrounded with a border of lighter scales; there are also transverse lines of scales towards the sides; the antennæ are rather long and cylindrical, and the tarsi one-jointed, terminated by a simple claw. The larva of *Stenotarsus obtusus* is less convex, oblong-oval, enlarged behind, and covered with long pale hairs, and with the abdominal segments, except the apical one, prolonged into obtuse lobes; the colour is yellow variegated with black; the larvæ undergo their transformations on the surface of the trees on which their fungoid food is situated, usually in the cracks and crevices.

The following is Gerstaecker's table modified by Gorham and Chapuis, and slightly altered in arrangement, etc.:—

I. Tarsi distinctly 4-jointed, the third joint being usually smaller than the second, which is simple; very rarely (*Mychophilus*, *Clemmys*) 3-jointed.

i. Antennæ 11-jointed .... MYCETÆINÆ (LEIESTINÆ).
ii. Antennæ 4-jointed .... TROCHOIDEINÆ.
II. Tarsi crypto-tetramerous, apparently 3-jointed, the third joint being very small and concealed between the lobes of the bilobed second joint.
i. Ligula oblong, with its free margin rounded.. ENDOMYCHINÆ.
ii. Ligula at least as broad as long, with its free margin truncate or emarginate.
1. Antennæ with the club very much compressed, sub-foliaceous.
A. Labial palpi with the last joint transverse. EUMORPHINÆ.
B. Labial palpi with the last joint quadrate . CORYNOMALINÆ.
2. Antennæ with the club subcylindrical or only slightly compressed.
A. Antennæ with joints 9-10 pointed and prolonged internally. .... EPIPOCINÆ.
B. Antennæ with joints 9-10 not prolonged internally.
a. Form oblong or elongate oblong ...... LYCOPERDINÆ.
b. Form short-oval or round .... STENOTARSINÆ.

Mr. Gorham (Biologia Centr.-Amer. vii, p. 115) places the ENDOMYCHIDÆ next to the EROTYLIDÆ, and says that the passage from the latter to the former through *Homœotelus* seems natural enough, and some species of *Brachysphenus*, such as *B. festivus*, have quite the facies of the ENDOMYCHIDÆ. "The family," he says, "is somewhat more specialised, but, on the other hand, its representatives are far inferior in number, both in genera and species, to the EROTYLIDÆ. The Palæarctic and Nearctic zones and low Southern latitudes possess few and feeble forms; as a group, they are a tropical development of a peculiar type that has never been dominant, dependent on special circumstances for their existence, and therefore rare in nature."

Family 47. COCCINELLIDÆ.

Form usually round, rarely oblong-oval, convex, head deeply sunk in thorax; antennæ inserted at the inner front margin of the eyes, eleven-jointed (rarely eight- to ten-jointed), with a variable, usually three-jointed, club; anterior coxal cavities open or closed behind; elytra with very distinct epipleuræ; anterior and posterior coxæ transverse and separated; legs short, usually strongly retractile, the posterior pair often fitting into more or less hollowed shallow plates (plaques abdominales); tarsi pseudo-trimerous, the third joint being very minute and concealed (except in* Lithophilus, *in which it is free);*

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* These are of great use in the separation of genera, as they vary much in size and shape; they are present to a less extent on the metasternum also.

claws appendiculate or toothed; epimera of mesosternum irregularly triangular, with the apex directed to the front.

This family comprises the well-known Lady-birds. It is very extensive and contains over 2000 species, as at present known; the greater part of these are carnivorous and in both the larval and the perfect state feed on Aphides, scale-insects, and other insects destructive to vegetation. They are therefore often of the greatest economic importance and most valuable allies to the agriculturist; a comparatively small section are plant-feeders, but they rarely do any appreciable damage.

The coloration is very variable, but for the most part the ground surface is characteristically spotted; the form is usually round and convex, sometimes almost hemispherical, but often more or less oblong-ovate; the upper surface is, as a rule, shiny and glabrous; in certain groups, however, it is distinctly pubescent. The position of the family has been much disputed in the past, and the COCCINELLIDÆ used to be placed in a division called the TRIMERA or PSEUDOTRIMERA, containing certain families that were then supposed universally to possess 3-jointed, or apparently 3-jointed, tarsi (EROTYLIDÆ, ENDOMYCHIDÆ, CORYLOPHIDÆ, SPHÆRIIDÆ, TRICHOPTERYGIDÆ, LATHRIDIIDÆ, and PSELAPHIDÆ). They have, however, for some time been rightly placed in the Clavicorn series and come near the ENDOMYCHIDÆ.

The larvæ vary in the different groups. Those of the insectivorous forms are active, somewhat brightly coloured, broad in front and narrow behind, and covered with more or less distinct spines and tubercles; before pupating, the larva (at any rate, in many cases) attaches its last segment to a leaf by means of a viscous substance which it secretes and bends the anterior portion of the body up towards the apical portion; the tubercles then diminish in size, and the skin splits on the back and shrinks into a wrinkled mass towards the apex of the body. The larvæ of the genus *Scymnus* and its allies, which in spite of their small size are very predaceous, have the power of exuding a waxy secretion, which is easily rubbed off, but can be renewed within twenty-four hours; it arises from pits on the surface of the insect, and takes the place of the ordinary spines. Reaumur first observed this, and called the larvæ in consequence "*Hérissons blancs*" or "*Barbets blancs.*" The larvæ of the plant-feeders are of different and simpler shape, and less active.

With regard to the distribution of the group it is worth while quoting again the words of Mr. Gorham[*], who has worked at the group more than any writer of recent years:—"The distribution is very remarkable and different to either of the two groups just mentioned (ENDOMYCHIDÆ and EROTYLIDÆ), being, if I may call it so, more universal, every known part of the globe which supports any insect-life having, as far as I can speak, an average number.

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[*] *Vide* Coleop. Brit. Islands, iii, p. 155.

The genera are *very* badly defined; hence my ideas of geographical genera seem quite upset; *Halyzia*, for instance, has representatives in Europe, North and South America, China, Japan, India, Africa, Australia, and the Pacific Islands; or if again we take the large genus *Epilachna* (containing 223 species), although it has an Eastern and a New World type very different in appearance, yet these cannot be separated generically without the process (which must at last take place) of subdivision into many genera, as there are contingents from every part of the world, and these not very much differentiated. I think that a careful analysis of the Coccinellidæ would show that they are a north temperate zone family, the tropical species having rather the appearance of being derived than of being autochthonous."

The Indian and Malay region is very rich in Coccinellidæ, especially in the fine and large forms belonging to the Cariinæ, Epilachninæ, etc.

The Lithophilinæ have the third joint of the tarsi free and not concealed, and bear the same relation to the rest of the family as the Dacninæ bear to the Erotylidæ, and the Mycetæinæ to the Endomychidæ; judging by the form of the mandibles they are carnivorous, but the exact nature of their food has not yet been ascertained.

The family may be roughly divided as follows:—

I. Third tarsal joint concealed in the lobes of the second joint; tarsi apparently 3-jointed.
  i. Mandibles with a basal tooth and with simple or bifid apex .... Coccinellinæ.
  ii. Mandibles without a basal tooth and with a multidentate apex .... Epilachninæ.
II. Third tarsal joint free; tarsi plainly 4-jointed.. Lithophilinæ.

Ganglbauer (*l. c.* p. 945) points out that Weise, who has given a good table of the European familes in the 'Bestimmungs Tabellen der europäischen Coleopteren,' has formed a third group (besides Chapuis' two groups) for the genera *Cœlopterus*, *Pharus* and *Stilocotis*, which he calls Pseudococcinellidæ. In these genera the apical joint of the maxillary palpi is not securiform or hatchet-shaped, as is usual in the family, but is conically pointed.

The only definite character on which the Coccinellidæ can be distinguished from the Endomychidæ appears to be the shape of the epimera of the mesosternum. The importance of this character was noticed by Chapuis (Lacordaire's Gen. Coléoptères, xii, p. 154); though whether it is sufficient to separate the families is doubtful. But for the well-known facies of the insects, they might with advantage be all united under one family.

Family 48. DERMESTIDÆ.

Head variable in size, deflexed, usually furnished with a frontal ocellus; antennæ inserted under the edge of the forehead a little in front of and between the eyes, short, with a very variable club, often with less than eleven joints; pronotum at base as broad as base of elytra; anterior coxal cavities open behind; elytra covering abdomen, which has five free ventral segments; legs short, somewhat retractile, tibiæ sometimes with distinct spurs; tarsi five-jointed; claws simple; surface, especially the underside, often very strongly pubescent, occasionally squamose.

This family contains about 300 or 400 species of small or moderate-sized insects. They frequent, for the most part, furs, hides, and the dried remains of the integuments of animals generally, also articles of food such as bacon, cheese, etc.; some of the small species, such as *Anthrenus*, which are found on flowers in the perfect state, in the larval state are found damaging collections of natural history objects, and are the bane of the collector. The perfect insects are comparatively harmless throughout the group, but the ravages of the larvæ are often most serious, and Professor Westwood mentions the fact that on one occasion *Dermestes vulpinus* had been found so injurious in the large skin warehouses of London, that a reward of £20,000 was offered for a remedy, but was not claimed. These larvæ are most peculiar and differ completely in facies from the general run of Coleopterous larvæ, through their hairy and sometimes furry upper surface, and in some cases, peculiar shape. Their chief characteristics are as follows:—Head small, rounded and corneous, convex in front; ocelli usually six on each side; antennæ short; labrum projecting; body covered with a thin skin, sometimes with corneous plates, sometimes coriaceous, more or less hairy; legs short, tarsal claws simple; anal segment serving as a proleg, or sometimes invisible. The most peculiar of the larvæ at present discovered is perhaps that of *Tiresias* (*Ctesias*) *serra*, which lives amongst cobwebs in old wood and is spread over the whole Palæarctic region; it has always attracted attention and has been described and figured by Waterhouse, Erichson, Decaux, Sharp, and others. It is remarkable for the dilatation of the hinder half of the body and the division of the hinder apparent segments into six furry divisions, three on each side; the surface is also furnished with long hairs, and there is a long hairy tail-like appendage; the anterior parts are comparatively narrow, and the first four abdominal segments are very short and form a waist.

Some of the DERMESTIDÆ, from their habits, have been widely distributed by commerce, and are more or less cosmopolitan; and the family generally is spread throughout the world, although it is more characteristic of temperate than tropical climates. Very few have been as yet recorded from India; one or two species of *Attagenus* and *Trinodes* have been described from Ceylon, and Motschulsky described the genera *Æthriostoma* and *Orphinus* from India and Burma respectively.

I. Head without frontal ocellus; mouth-parts not covered .... DERMESTINÆ.
II. Head with frontal ocellus.
  i. Mouth-parts not covered; anterior coxæ strongly projecting .... ATTAGENINÆ.
  ii. Mouth-parts covered by the prosternum or by the coxæ and trochanters of the front legs.
    1. Prosternum horizontal; hind coxæ not reaching the side margins of the body, which is hairy or squamose.
      A. Form oblong; posterior coxæ contiguous; upper surface with recumbent hairs ...... MEGATOMINÆ.
      B. Form short, round or short-oval; posterior coxæ not contiguous.
        a. Upper surface squamose; head with deep antennal grooves beneath .... ANTHRENINÆ.
        b. Upper surface with stiff upright bristles; head without antennal grooves........ TRINODINÆ.
    2. Prosternum vertical; hind coxæ reaching the side margins of the body; upper surface bare and glabrous .... ORPHILINÆ.

Family 49. BYRRHIDÆ.

Form oval or round oval, very strongly convex; head with the forehead vertical and the mouth-parts mostly concealed by the prosternum; antennæ inserted under the edge of the forehead between the eyes, short, eleven-jointed with a more or less pronounced club; anterior coxal cavities open behind; anterior coxæ transverse, not exserted; pronotum at base as broad as elytra; legs short, retractile; femora with a furrow for the reception of the tibiæ; tarsi five-jointed, rarely four-jointed; abdomen with five free ventral segments.

The members of this family are often called Pill-beetles from the fact that the legs and antennæ can be completely adpressed to the body; when the insects are alarmed they remain motionless and, as they often very closely resemble their surroundings, they thus escape; they are also to a certain extent protected by their hard integuments. The larvæ of *Byrrhus* are cylindrical and soft with a broad short head, and a very large and broad chitinous and somewhat strongly sculptured pronotum, which is much longer than the succeeding segments; towards the apex the segments again increase in size, the apical one being almost as large as the pronotal, and bearing two retractile pseudopods.

The habits of the family are but little known. *Byrrhus* is a moss feeder; *Limnichus* is found only in damp places; while the species of the tropical genus *Chelonarium* occur on leaves of plants and on thorns, and drop immediately on being alarmed.

The family contains altogether some 200 to 300 species. The genus *Byrrhus* is entirely or almost entirely Palæarctic, but *Syncalypta* and *Limnichus* are represented in India and Ceylon, and six Indian species of a new genus *Byrrhinus* were described by Motschulsky; very little attention, however, has been paid to the group within our limits.

Dr. Sharp, the most recent writer on the family (Biol. Centr.-Amer., Coleopt. ii. 1, p. 670), in speaking of its position, etc., says it is not clear that it can be separated from either the PARNIDÆ or DASCILLIDÆ, and that the recognized subfamilies of BYRRHIDÆ have little connection beyond the fact that all have peculiar arrangements for retracting the legs and packing them very close to the body, and further on (*l. c.* p. 684), in discussing the position of the doubtful genus *Chelonarium*, he says:—"By the early authors *Chelonarium* was placed in THROSCIDÆ. In the Munich Catalogue it is placed in BYRRHIDÆ, but on what grounds I do not know. It appears to me to be more allied to DASCILLIDÆ than to any other Coleoptera. The limits of the families BYRRHIDÆ, PARNIDÆ, and DASCILLIDÆ are at present merely conventional, and, as they will probably be united, it is not necessary to further discuss the position of *Chelonarium*."

I. Antennæ inserted at the sides of the head; antennæ, as a rule, more or less clavate.	
i. Clypeus not distinct from the frons; posterior coxæ almost touching one another........	BYRRHINÆ.
ii. Clypeus separated from the forehead by a fine suture; posterior coxæ more or less widely separated.	
1. Prosternum without antennal grooves	LIMNICHINÆ.
2. Prosternum within the front angles with a deep furrow for the reception of the antennal club	BOTHRIOPHORINÆ.
II. Antennæ inserted on the front, filiform	CHELONARIINÆ.

Family 50. NOSODENDRIDÆ.

Form short oval, strongly convex; head prominent, mentum large, more or less concealing the mouth-parts; antennæ inserted under the side edge of the forehead, in front of the eyes, eleven-jointed with a three-jointed club; elytra covering abdomen; anterior coxal cavities widely open behind; legs short and retractile; tarsi five-jointed; abdomen with five free ventral segments.

This family contains one genus *Nosodendron*, which is widely distributed, one species being spread over the greater part of

Europe, seven or eight occurring in North and Central America, and one in Ceylon. They have been included by many authors under the **Byrrhidæ**, which they closely resemble in general form, retractile legs, grooved femora and tibiæ, etc.; they are, however, distinguished from them by the formation of the head and mentum and especially by their larvæ, which are quite different from those of the **Byrrhidæ**. Lacordaire (Gen. et Spec. Col. ii, p. 478) seems to be of the opinion that they ought hardly to be placed near the **Byrrhidæ**, but knows of no better position. Thomson (Skand. Col. iv, p. 154) assigns them a position among the **Nitidulidæ**, between *Cryptarcha* and *Thymalus*; but in the form of the legs and coxæ, wing-venation, etc., they are widely separated from this family.

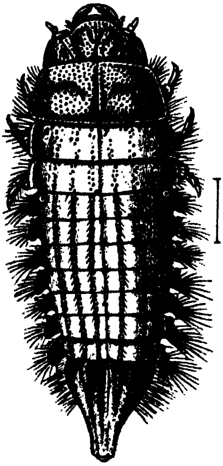

Fig. 54. — *Nosodendron fasciculare.* Larva, ×7. (After Ganglbauer.)

The larva of *Nosodendron fasciculare* is very peculiar; it has been noticed by other authors, but a very full description with an excellent figure is given by Ganglbauer (Käfer Mitt. Eur. iv, 1, p. 89). It is rather large compared with the perfect insect, being 8 mm. in length, and it is broad in proportion; the chief peculiarities are the stalked stigmata, which are situated on tubercles, the dorsal position of the first and terminal position of the second abdominal pairs, and the broad somewhat recurved processes at the sides of the first seven abdominal segments. The sculpture also is peculiar: the eighth segment is long and pear-shaped and bears no cerci; the general shape is somewhat onisciform.

The species as a rule live at and about the running sap of wounded trees; *M. mexicanum*, however, occurs in muddy places.

[Family 51. CYATHOCERIDÆ.]

"*Minute insects of broad form; parts of the mouth concealed; antennæ four-jointed; tarsi not divided into joints; prosternum small*" (Sharp).

One species only (*Cyathocerus horni*) is known of this family, which is very anomalous and aberrant, and nothing is known as to its life-history; it occurs in Central America. Dr. Sharp (Cambridge Nat. Hist. vi, p. 243) places it between the **Byrrhidæ** and **Georyssidæ**.

Family 52. GEORYSSIDÆ.

Small compact insects; antennæ inserted under the sides of the front, short, nine-jointed, with the last three joints forming an oval club which is received in a deep prosternal groove; prosternum very small; anterior coxæ prominent, forming two small plate (with a fissure between them) concealing the prosternum; intermediate and posterior coxæ distant; elytra covering abdomen, coarsely sculptured; legs long, with slender tibiæ and four-jointed tarsi; abdomen with five free ventral segments, the first very large and the last three free.

This family consists of one genus only, comprising, as at present known, about two dozen species which are very widely distributed throughout the world, in Europe, North America, Ceylon, Australia, etc. They are apparently closely allied to *Elmis*, but are quite distinct by reason of the peculiar formation of the prosternum and the anterior coxæ. The beetles live in sandy or muddy places, and cover themselves with a coating of fine sand or mud, so that they are quite invisible unless they begin to move about; according to Erichson this covering is cemented together and kept on their backs by a sticky secretion.

Nothing, apparently, is known of their larvæ or life-history.

Family 53. DRYOPIDÆ (PARNIDÆ) *.

Form variable; head usually retractile; antennæ very variable, long or moderately long, serrate or filiform, or very short with the second joint dilated and ear-shaped; eyes rounded, sometimes hairy; all the coxæ distant; anterior coxal cavities open behind; prosternum usually elongate, forming a process behind which is received into a cavity of the mesosternum; epimera of metasternum reaching the coxal cavities; legs slender, long or very long; tarsi elongate, five-jointed, the last joint usually as long as all the preceding together; abdomen usually with five free visible ventral segments (in Psephenus *with seven in the male and six in the female).*

The name DRYOPIDÆ must be adopted for the family, as the generic name *Dryops* of Olivier is one year (1791) prior to the Fabrician name *Parnus* (1792). It consists of about 300 or 400 species, as at present known, but is probably much more extensive, as it has been much neglected. Scarcely any have been recorded from India; *Stenelmis*, however, is represented by two species and Erichson described *Ancyronyx* from Ceylon, the latter genus being allied to the European and North American *Macronychus.*

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* Including ELMIDÆ.

The members of the family vary considerably in shape, but are much alike in their habits, being found for the most part in running water, clinging with their strong claws to water-plants or submerged logs or to the undersides of stones. Many of them are strongly pubescent beneath, and some also above, and they are thus able to carry a film of air with them for respiration under water; they have no power of swimming, although most of their life is aquatic.

The larvæ are found with the perfect insects and are very variable; those of *Dryops* are said to live in damp earth under stones and to resemble the larvæ of ELATERIDÆ. The larvæ of *Elmis* are very different, being elongate-elliptical, but narrowed behind, with the segments extended at each side and furnished laterally with long hairs; the abdomen ends in a long narrow smooth anal appendage terminated by three sets of filamentous branchiæ through which the insects respire.

The North American genus *Psephenus* is placed by some authors in the DRYOPIDÆ and by others is regarded as a separate family. Dr. Horn not long before his death kindly sent me a pamphlet of his from the 'Transactions of the American Entomological Society,' x, 1882, containing notes on some "Little known Genera and Species of Coleoptera," with figures of the upper and under side of this anomalous insect. As he points out, the structure of the legs and antennæ is decidedly like that of *Elmis*, while that of the underside is very like certain DASCILLIDÆ, and he believes that *Psephenus* is a genus "with Elmid affinities pointing strongly in the direction of the Eubriid series of DASCILLIDÆ." The larva of the genus is especially abundant in the rapids of Niagara and is peculiar in shape, being entirely elliptical and crustaceiform. According to Leconte and Horn, however, who had plenty of opportunities of seeing it, it differs but little from the larva of *Helichus*, which they place in their tribe PARNINI. The position of the DRYOPIDÆ is evidently near the HETEROCERIDÆ, and one or two authors (*e. g.* Lameere, Ann. Soc. Ent. Belg. 1900, p. 363) include the latter family under the former; they are, however, quite distinct both as regards the perfect insect and the larva.

I. Abdomen with five visible ventral segments.
  i. Anterior coxæ transverse, with distinct trochantin .... DRYOPINÆ.
  ii. Anterior coxæ globular, without trochantin .. ELMINÆ.
II. Abdomen with seven visible ventral segments in the male and six in the female; anterior coxæ with very large trochantin .... PSEPHENINÆ.

Family 54. HYDROPHILIDÆ.

Very variable in size (*¼ mm. to* 50 *mm.*)*; antennæ inserted before the eyes under the front angles of the forehead, short, six- to nine-jointed, with the apical joints forming a pubescent club; maxillary palpi often very long, much longer than the antennæ; mentum large, quadrate; eyes round or emarginate, rarely entirely divided* (Amphiops)*; prosternum very short; mesosternum moderate, often raised longitudinally, sometimes produced into a long spine; legs furnished in some species with swimming hairs; tarsi five-jointed, the first joint sometimes very small, sometimes* (Cymbiodyta, Hydrocombus) *obsolete; abdomen as a rule with five free visible ventral segments, sometimes* (Limnebius) *seven, very rarely* (Cyllidium) *four.*

This is a very large and important family, comprising about 1000 known species. Dr. Sharp, however, believes that this is not a tenth part of the existing number, and he is probably right in saying that the family is likely to prove of even greater extent and importance than the Dytiscidæ: for the last-named family is rich in species in the colder regions of the earth's surface, while the Hydrophilidæ are more numerous in the warmer regions, and have as yet been very little worked in comparison with the northern Dytiscidæ. They are extremely variable in size, and as a large number of the members of the family are small and obscure insects, they have been much neglected. They are probably abundant in India, the following genera being among those represented there:—*Hydrophilus*, *Hydrous*, *Sternolophus*, *Hydrobius*, *Philhydrus*, *Berosus*, *Brachygaster*, *Globaria*, *Amphiops*, *Hydrochus*, *Cyclonotum*, *Cercyon* and *Sphæridium*.

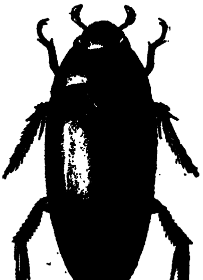

Fig. 55.
Hydrophilus olivaceus.

A considerable number of the species have the maxillary palpi very long, much longer than the antennæ, and on this account Mulsant and others have given the name Palpicornia or Palpicornes to the family; the character is not, however, very strongly marked in all cases.

The larvæ of the group are very different, several of them presenting very strange characters. Schiödte in his work on the larvæ of Coleoptera (Naturhist. Tidsskr. 1861–1873, T. viii–ix) has described and figured the larvæ of eight or nine genera. The head, as a rule, is small, but in *Spercheus* it is very large; in *Hydrous* the segments are furnished at the sides with long fringed appendages (much as in *Gyrinus*) which appear to aid respiration; in the case of *Berosus* the larva is broad, fusiform, and furnished at the sides with very long and slender branchial appendages, some of which are almost as long as the whole abdomen; the larva of *Helophorus* is parallel-sided, with the prothoracic segments chitinous and with chitinous plates on the abdomen, without lateral processes, but with two very long 3-jointed cerci at the apex; the larva of *Sphæridium* is grub-shaped, considerably narrowed in front, with an extremely small head, and a broad anal segment, with four short teeth at the apex, and two conical appendages on each side; it is practically legless; that of *Cercyon* differs little but in minor particulars. *Spercheus* possesses a very distinct larva, broad and more or less ovate, with a very large head and powerful jaws, with hairy protuberances at the sides of the abdominal segments, no distinct anal appendage or cerci, and with very different mouth-parts to those found in the allied genera. In *Octhebius* the larva possesses a developed extra mouth-segment, and short 2-jointed cerci.

From these very brief descriptions it will be seen that there is no other family that possesses such heterogeneous larvæ, and it is a question whether the family ought not to be subdivided on their characters; in any case it might be of advantage to consider the SPERCHEINÆ as separate. Ganglbauer (Die Käfer von Mitteleuropa, iv, 1, p. 152) divides the family into subfamilies largely on these larval characters, and his table is well worth consulting as so many of the European genera are found in the tropics.

The young larva of *Spercheus* and its habits are described by myself (with figures by the Rev. A. Matthews, in Ent. Monthly Magazine, xix, p. 79). The female carries her eggs in a bag attached to the abdomen until they are hatched, and she can produce several batches of eggs in succession without the intervention of the male. The larvæ are carnivorous and in confinement prey upon one another; they walk upon the surface of the water, back downwards, like the perfect insect. The latter possesses a rather strong stridulatory organ.

In the perfect state the members of the family feed on decomposing vegetable matter, but the larvæ of the HYDROPHILINÆ appear to be essentially carnivorous and predaceous; their habits are, in some cases, very interesting, but we have no space here to discuss them.

I. Posterior tarsi with the first joint very short, often not visible from above.
  i. Second joint of posterior tarsi elongate, longer than third; first joint very short; pronotum at base as wide as elytra.
    1. Posterior tarsi oar-shaped; metasternum prolonged into a sharp elongate spine .... HYDROPHILINÆ.
    2. Posterior tarsi not oar-shaped; metasternum not prolonged into a spine.............. HYDROBIINÆ.

ii. Second joint of posterior tarsi short, about equal to the third.
  1. Pronotum at base narrower than the base of the elytra, with distinct longitudinal furrows .... HELOPHORINÆ.
  2. Pronotum at base not narrower than the base of the elytra, without distinct longitudinal furrows.
    A. Clypeus emarginate; scutellum long, triangular; anterior coxal cavities open behind .... SPERCHEINÆ.
    B. Clypeus truncate; scutellum small and short; anterior coxal cavities closed behind .... HYDRÆNINÆ.

II. Posterior tarsi with the first joint elongate .... SPHÆRIDIINÆ.

Amphiops might with reason be separated as a separate subfamily (Amphiopinæ), on the character of its completely divided eyes, which are analogous to those of *Gyrinus*.

The position of the Hydrophilidæ is doubtful. They certainly exhibit a strong relationship towards the Dytiscidæ, and Sharp (Cambridge Nat. History, vi, p. 21) places them after the Gyrinidæ. Some authors place them between the Clavicornia and the Lamellicornia, while Ganglbauer places them at the end of the old Clavicorn series immediately after the Heteroceridæ. This he does, apparently, in order to separate them off from the preceding families; in fact he is inclined to regard them as quite a separate division (Palpicornia). So far as the wing venation goes they certainly belong to his Diversicornia, as the characteristic loop is very distinct in *Hydrophilus*, etc.

Family 55. HETEROCERIDÆ.

Head large, sunk in the thorax as far as the eyes, porrect or only slightly deflexed, mandibles projecting; antennæ short, variable, ten- or eleven-jointed with (usually) the last seven joints forming a compressed serrate club; anterior coxal cavities open behind; elytra completely covering the abdomen, which has five free ventral segments, the first of which is furnished with a stridulating organ in the form of an elevated curved line rubbed by the posterior femur; legs stout, spinose, adapted for digging; tarsi four-jointed, with delicate claws.

This family consisted originally of one large genus, to which one or two have been added since the publication of the Munich Catalogue. About 100 species are known, and they are widely distributed throughout the world; the majority inhabit the Palæarctic region, but some half-dozen occur in India and Ceylon, and species have been recorded from Cuba and Australia. They are small insects, with a fine but dense pubescence; they are sluggish in their movements and live in galleries which they excavate in soft mud near pools and small lakes, or on the margins of muddy streams, the ramifications of these burrows being very conspicuous. The species have been supposed to be carnivorous in their habits, but this has not been proved and it is believed that they eat the mud into which they burrow. They have, in very many cases, a strong family resemblance, and it is often exceedingly hard to determine the species.

The larvæ are cylindrical, but the thoracic segments are considerably broader than the abdominal segments and are furnished with chitinous plates; the abdomen is subparallel-sided, gradually narrowed before the apex, and ends in a small projecting pseudopod; there are no cerci; the antennæ are rudimentary and the legs short and rather stout; the whole surface is thickly clothed with fine pubescence, with long outstanding hairs at the sides; the stigmata are differently arranged from those of the larvæ of the DRYOPIDÆ with which they have been associated, but from which they differ in several important points.

Division 3. SERRICORNIA.

For the sake of convenience the name SERRICORNIA has been retained for the families included in this section, but the antennæ vary very greatly, being filiform in *Cantharis* (*Telephorus*) and clavate in *Corynetes* and certain other CLERIDÆ; the gradual transition, however, is very remarkable, the CANTHARINÆ soon branching off into flabellate or even plumose forms, while the irregularly clavate-serrate antennæ of *Aulicus* and *Dorcatoma* lead naturally to *Corynetes*. The purely serrate antennæ are found among the ELATERIDÆ and their allies, but among these we find strongly developed pectinate forms as in *Corymbites*. The DASCILLIDÆ ought perhaps to be referred to the BYRRHIDÆ and DRYOPIDÆ and classed with them as one family, but the remainder of the families form a distinct, although somewhat heterogeneous group, which ought probably, as we have said before, to be placed before the CLAVICORNIA in the phylogenetic series. The larvæ are excessively variable, both in form and habitat.

Key to the Families.

I. Prosternum not prolonged behind the anterior coxæ (except slightly in certain DASCILLIDÆ).
  i. Tarsi 5-jointed.
    1. First ventral segment not elongate.
      A. Onychium large and hairy; posterior coxæ sulcate; antennæ usually flabellate in the male .. **Rhipiceridæ**, p. 134.

B. Onychium small.
a. Posterior coxæ sulcate for the reception of the femora.
*a**. Posterior coxæ more or less dilated; epimera of mesosternum reaching the coxæ.
a†. Anterior coxæ with a large and distinct trochantin .. **Dascillidæ**, p. 133.
b†. Anterior coxæ without trochantin .... **Helodidæ**, p. 133.
*b**. Posterior coxæ not or scarcely dilated; sulcation of these much more marked in the ANOBIINÆ than in the PTININÆ; epimera of mesosternum not reaching the coxæ .... **Anobiidæ (Ptinidæ)**, [p. 143.
b. Posterior coxæ not sulcate.
*a**. Epimera of mesosternum not reaching the coxæ; first joint of tarsi very short, sometimes obsolete .... **Bostrychidæ**, p. 144.
*b**. Epimera of mesosternum reaching the coxæ.
a†. Posterior coxæ flat; tarsi with membranous lobes beneath.............. **Cleridæ**, p. 139.
b†. Posterior coxæ prominent; tarsi without membranous lobes.
a‡. Anterior coxæ without trochantin; maxillary palpi in the male (except very rarely) large and flabellate .... **Lymexylonidæ**, p. 141.
b‡. Anterior coxæ with a distinct trochantin.
* Abdomen with seven or eight ventral segments .... **Cantharidæ (Telephoridæ)**, p. 135.
** Abdomen with six (rarely five) ventral segments .... **Melyridæ**, p. 138.
2. First ventral segment elongate: antennæ terminated by a 2-jointed club .... **Lyctidæ**, p. 145.
ii. Tarsi 4-jointed .... **Cioidæ**, p. 146.

II. Prosternum produced between the anterior coxæ and fitting into a groove on the mesosternum.
i. First and second ventral segments connate; integument as a rule metallic, often very brilliant; larvæ with the anterior three or four segments much broader than the rest .... **Buprestidæ**, p. 147.

ii. First and second ventral segments not connate; integument occasionally metallic, but much less so as a rule than in the BUPRESTIDÆ; larvæ more or less parallel-sided, rarely (e.g. *Melasis*) with the anterior segment a little broader than the rest.

1. Anterior coxal cavities open behind, but entirely presternal	**Elateridæ**, p. 151.
2. Anterior coxal cavities formed partly by the prosternum and partly by the mesosternum	**Throscidæ**, p. 154.

Family 56. DASCILLIDÆ.

Antennæ inserted immediately in front of the eyes, eleven-jointed, serrate, rarely pectinate or flabellate; mandibles short; mentum chitinous; ligula large, membranous, often divided into narrow lobes; anterior and posterior coxæ transverse, the latter forming a plate for the reception of the femora, the former with a large trochantin; tarsi five-jointed, often with membranous lobes beneath; larvæ (as far as known) with short, few-jointed, antennæ.

This family ought perhaps to be associated with the DRYOPIDÆ and BYRRHIDÆ, to which it is closely related. Probably about 100 species are known, hardly any of which have been found in India; two species only, belonging to the genus *Dascillus*, are mentioned in Gemminger and Von Harold's catalogue.

The larva of *Dascillus* has recently been described and figured by Mr. C. J. Gahan (Trans. Ent. Soc. London, 1908, ii, p. 280, pl. vi, fig. 2). It is short and stout, broad throughout, but narrower behind than in front, with a very large broad head, and large and prominent triturating mandibles; the antennæ are 4-jointed, very short, not extending to the apex of the mandibles. In almost every respect the larva differs widely from those of the HELODIDÆ which are at present known.

Family 57. HELODIDÆ.

In many points agreeing with the DASCILLIDÆ, with which it has been classed as a sub-family by many authors; the integument, however, is much softer, the antennæ are filiform and much more slender, and the anterior coxæ have no trochantin; the larva is quite different, possessing long, filamentous, many-jointed antennæ, which are often half as long as the body.

A considerable number of small delicate insects with very soft and delicate integument and loosely articulated limbs are comprised in this family. Their habits are to a great extent aquatic or subaquatic, and in some cases (e. g. *Prionocyphon*) very peculiar, the larvæ living in stagnant water in and about hollows of trees, etc.

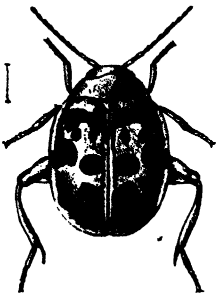

Fig. 56.—*Scirtes pictus.*

The larva of *Helodes* possesses only abdominal spiracles and breathes by coming to the surface of the water and taking a bubble of air down with it; the larva of *Cyphon* is remarkable for its long antennæ, short legs and ciliate sides of the body; in these respects it resembles that of *Hydrocyphon*, which is furnished with curious retractile appendages at the end of the last segment of the body.

About 300 species are known, but probably the family is very extensive, as it has been greatly neglected; it has most likely a wide range in the Indian Region, but only a few species have hitherto been recorded; among these are members of *Helodes*, *Hydrocyphon* and *Scirtes*.

Family 58. RHIPICERIDÆ.

Rather large and conspicuous insects of very characteristic appearance; antennæ inserted on the forehead well in front of the eyes, usually flabellate, with the processes very long in the males, serrate in the females; anterior and middle coxæ conico-cylindrical, prominent, the former with large trochantins, anterior pair contiguous, intermediate pair separated; elytra covering abdomen, epipleuræ extending to apex; tarsi five-jointed with the onychium broad and hairy and extended between the claws.

Nine genera and fifty-nine species are mentioned in the Munich Catalogue, and not many have been described since. They are widely distributed in both the Old and the New World, the genus *Callirhipis* being represented in the Indian Region.

The position of the family is somewhat difficult to determine, but is apparently near the DASCILLIDÆ.

The perfect insects are found some on trees and some on low plants, and some under leaves; the species of *Sandalus*, according to Leconte and Horn, affect various cedars. Not much appears to be known about them, but Schiödte devotes a whole part (xii) of his work 'De metamorphosi Eleutheratorum' to the description of the larva and pupa of one species, *Callirhipis dejeani*. This larva is peculiarly cylindrical throughout, the last apparent segment being as broad as the first and truncate; both the larva and pupa appear to be very long in proportion to the perfect insect.

Family 59. CANTHARIDÆ (TELEPHORIDÆ).

Form variable, but in most cases, except in the LYCINÆ, *elongate; integument soft; body loosely jointed; antennæ filiform or more or less serrate, rarely pectinate, flabellate or plumose, usually eleven-jointed; anterior and intermediate coxæ conico-cylindrical, the trochantins of the first always distinct; posterior coxæ transverse; abdomen with seven or eight visible ventral segments; legs usually long and slender, never much thickened, tarsi five-jointed; female, in certain cases, without wings or elytra, and then, as a rule, luminous.*

This family is here regarded as including the LYCINÆ, LAMPYRINÆ, CANTHARINÆ and DRILINÆ. These are sometimes regarded as distinct families, but they can hardly be separated. Sharp adopts the name MALACODERMIDÆ for the family, but, as this or a similar term has been used by many authors in a much wider sense, it is better not to adopt it for a restricted group. We have here employed the name CANTHARIDÆ as this seems to be now most generally accepted, although it must be allowed that some confusion has arisen from the fact that *Cantharis* has for many years been used for *Lytta*. It is better, however, to correct this confusion than to continue it, as the term CANTHARIDÆ seems to be rightly used in this connection on the grounds of priority.

The four subfamilies may be divided as follows:—

I. Antennæ inserted on the upper surface of the head, or at the base of the projecting portion of the front.	
i. Intermediate coxæ distant	LYCINÆ.
ii. Intermediate coxæ contiguous.	
1. Antennæ more or less approximate; epipleuræ usually wide at the base	LAMPYRINÆ.
2. Antennæ distant; epipleuræ narrow at the base	CANTHARINÆ. (TELEPHORINÆ).
II. Antennæ inserted at the sides of the front, before the eyes; intermediate coxæ contiguous.	DRILINÆ.

The total number of species of LAMPYRINÆ at present known must amount to over 2000. The LYCINÆ are chiefly found in the tropics, while the CANTHARINÆ are more characteristic of temperate climates; the LAMPYRINÆ are well represented in both, although a larger number are apparently found in warm countries, and the same may be said of the comparatively few genera of the DRILINÆ; the genus *Drilus* itself, however, appears to be almost confined to the temperate zone.

The LYCINÆ are diurnal and are found on the leaves of plants and in flowers; they are carnivorous in their habits; in form they are very variable, the genus *Lycus* being very peculiar with much dilated and sometimes almost semicircular foliaceous elytra. The species of the group including *Eros* and its allies are more like the LAMPYRINÆ, while *Lygistopterus* and *Calochromus* tend towards the TELEPHORINÆ. Not much appears to be known about the life-history of the species; the larva of *Dictyoptera sanguinea* is flat and linear, narrowed in front and behind, deep black above and whitish with black spots beneath; the last segment is chitinous, reddish in colour, and terminates in two projecting bent horny processes.

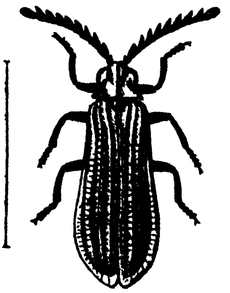

Fig. 57.
Macrolycus bowringi.

Several of the forms allied to *Dictyoptera* and *Eros* are mimicked very closely by certain Longicorns.

The LAMPYRINÆ are the most interesting members of the family as they contain the "glow-worms," which give off a more or less bright light; in most cases this phosphorescent light is brightest in the females, and evidently serves as an attraction to the males, but the males usually possess the power of giving light to a greater or less degree, and in some cases are more brilliant than the females. A great deal has been written by various authors as to the nature of the luminosity, but very little as yet is known about it; it is apparently due to the oxidation of some fatty substance formed or secreted within the body.

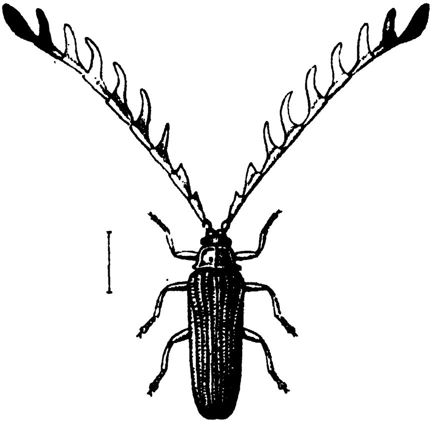

Fig. 58.—*Alebrus expansicornis.*

In most cases there is but little difference in general appearance between the female and the larva, whereas the males are perfect

Coleoptera with large and ample wings and elytra. The most larva-like female is perhaps that of the extraordinary American genus *Phengodes* *.

The Lampyrinæ are, as might be expected, almost entirely nocturnal in their habits. As Lacordaire points out (Gen. des Coléopt. iv, p. 307) they were at first believed to be phytophagous, but they are probably carnivorous as larvæ, and eat nothing in the perfect state. The Cantharinæ are elongate and in some cases very delicate insects (*Malthodes*, etc.). They are of simple structure, do not differ in the sexes and are for the most part fiercely carnivorous, sometimes tearing each other in pieces; the members of the genus *Cantharis* (*Telephorus*) are the well-known "soldier-beetles." The larvæ of the genus are lampyriform, of a velvety consistency, black or variegated, with an exposed scaly flat head, short antennæ, and a single ocellus behind each antenna; the anal segment is furnished on the underside with a fleshy tubercle or proleg, but there are no cerci or processes.

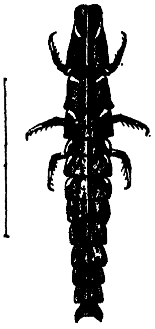
Fig. 59.
Lampyrid larva.

The composition of the Drilinæ is somewhat uncertain, as it is doubtful whether three or four of the genera that have been assigned to the subfamily ought not to be referred to other families. The genus *Drilus* is chiefly remarkable for the very peculiar female. The male of *Drilus flavescens* is a small *Cantharis*-like insect, with long pectinate antennæ, only 5–6 mm. in length, whereas the female is large (18 mm.), larviform, apterous, and hairy, composed of twelve segments, of which the last is terminated by two short processes and a short cylindrical appendage; the body is widened behind, and gradually narrowed in front. The larva of the female is very like the perfect insect in general appearance; it is very voracious and devours snails, within the shells of which it undergoes its transformations, closing the entrance (according to Westwood) with its exuviæ, and apparently having the power of spinning a sort of web of filaments.

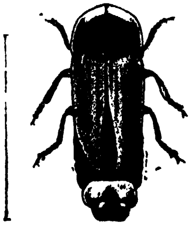
Fig. 60.
Lamprophorus tenebrosus.

It is probable that the Cantharidæ of India will be found to be much more numerous than would appear from the list of species at present known. *Lycus* is well represented and widely distributed, and among other genera which occur sparingly the following may be mentioned:—*Dictyoptera*, *Cœnia*, *Lampyris*, *Lamprophorus*, *Luciola*, *Cantharis*, *Silis*, *Icthyurus*, *Malthinus*, and *Malthodes*. *Eugeusis*, *Dodecatoma*, and *Pachytarsus*, which have been referred to the DRILINÆ, are peculiar to Ceylon and the Deccan.

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* *Phengodes* is placed by Lacordaire among the Cantharinæ, but this is evidently an error.

Family 60. MELYRIDÆ.

Closely allied to the CANTHARIDÆ, *under which it is included by some authors, but distinguished by having only six visible ventral segments of the abdomen; antennæ inserted laterally (except in* Malachius, *in which they are inserted on the front), filiform or serrate; clypeus separated from the front by a distinct suture; intermediate coxæ contiguous; tarsi five-jointed (anterior pair in the male occasionally four-jointed), claws often furnished with a membranous appendage beneath.*

This family contains, as at present known, upwards of 1000 species, but it has been as yet very little worked and the numbers will probably be very largely increased. Many of the earlier genera have a soft integument, but others such as *Dasytes*, *Zygia*, etc. are much harder. They are very variable, *Malachius* being short and rather broad, while certain species of *Dolichosoma* are elongate and very narrow. *Malachius*, and the allied genera, of which there are a considerable number, are remarkable for having fleshy vesicles at the sides of the pronotum and of the abdomen, which are capable of extension and contraction. The use of these is not quite obvious; according to one theory they are balancing organs (in flight), according to another they are scare organs, while some believe that they emit an odour disagreeable to their enemies; the latter is probably the correct explanation. The species are usually found in flowers, but some occur in rotten wood; they are probably, in most cases, carnivorous, but this is not certain.

Several larvæ of *Malachius*, *Axinotarsus*, and *Antholinus*, which have been described and figured by Perris, so closely resemble one another that it is difficult to distinguish them, except by size. They are elongate and sublinear, slightly narrowed in front and behind, with rather a long and narrow head, and with hairs and single long setæ at the sides of the abdominal segments and on the head and last segment; the legs are comparatively long; the head and last segment, which terminates in two chitinous and somewhat hooked processes, are dark, and the ground-colour of the rest of the body is pale or livid rose, with spots or patches on the front parts; in *Hypebæus* the processes of the last segment consist of two straight blunt tubercles. The larva of *Dasytes* has the anterior segments rather narrower than the posterior.

The most curious of the MELYRIDÆ is the abnormally-shaped *Myrmecospectra nietneri*, which occurs in Ceylon; it is, however, a member of this family, and the fact that Motschulsky, who described it, could have referred it to the PTINIDÆ, tends to raise considerable doubt with regard to the correctness of other of his generic determinations.

The family is chiefly found in temperate countries, very few species having been recorded from the Indian region. The following genera, however, are among those represented in India and Ceylon:—*Collops*, *Laius*, *Malachius*, *Carphurus*, *Danacæa*, *Pelecophorus*, *Idgia*, and *Melyris*.

Family 61. CLERIDÆ.

Form more or less elongate; head prominent, with the eyes often emarginate; antennæ inserted at the sides of the front, usually eleven-jointed, simple, serrate, pectinate or with a distinct club; labial palpi, as a rule, dilated and securiform; prosternum short, anterior coxal cavities open or closed behind; anterior coxæ prominent, contiguous or very slightly separated; elytra usually covering abdomen; abdomen with five or six free ventral segments; legs slender, often elongate, tarsi five-jointed, with the first joint in some genera very indistinct and covered by the second, and the fourth joint in others very small and indistinct, joints two to four as a rule furnished with membranous appendages beneath.

The insects belonging to this family are very variable in size, form and coloration, the latter being often very striking. About 1000 species are known, the greater number of which are found in tropical countries, only about fifty species occurring in Europe. The family is evidently well represented in India, the following being some of the genera which occur:—*Cladiscus*, *Tillus*, *Opilo*, *Tillicerus*, *Thanasimus*, *Clerus*, *Stigmatium*, *Ommadius*, *Lemidia*, *Tenerus*, *Necrobia*, and *Opetiopselaphus*. When the family has been thoroughly worked it is probable that the number of the species in the region will be increased twenty- or thirty-fold, as compared with those described up to the present.

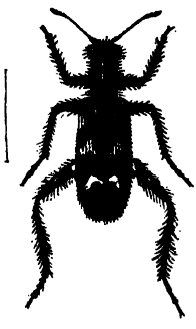

Fig. 61.
Ommadius tricinctus.

The larvæ of the CLERIDÆ are elongate, usually of a reddish, reddish-brown or pinkish colour, or somewhat variegated, with rather thick pubescence. The larvæ of *Trichodes* were called "red-worms" by Swammerdam, who first described their habits; they are furnished above with chitinous plates on the thoracic segments, and the last segment is chitinous and bears at its apex two projecting points, and a short anal appendage; there are five ocelli on each side of the head. These larvæ are parasitic and devour the larvæ of various bees; the larvæ and perfect insects of other species enter the borings of certain beetles and destroy their larvæ. Thus *Tillus elongatus* preys upon *Ptilinus*; *Thanasimus formicarius* on *Hylastes*, and *Corynetes* on *Anobium*. They are therefore decidedly useful insects.

Certain of the CLERIDÆ are very like bees (this is especially the case with *Trichodes*), while others bear a strong resemblance to large ants; these resemblances are probably very useful in the economy of the insect.

The species of *Necrobia* and its allies are in many cases found in old bones, hides, etc., and have been widely spread by commerce until they are now cosmopolitan. The following are the chief divisions of the family as given by Lacordaire, and in substance by Leconte and Horn, and recently by Schenkling (Wytsman's 'Genera Insectorum').

I. Tarsi 5-jointed; pronotum continuous with the parapleuræ.
  i. All the tarsal joints visible from above ...... TILLINÆ.
  ii. Not all the tarsal joints visible from above; at most this is the case with the front tarsi, and, apart from these exceptions, the first joint is covered by the second and is sometimes very small.
    1. Eyes emarginate.
      A. Eyes emarginate in front, as a rule strongly, rarely feebly .... CLERINÆ.
      B. Eyes emarginate on their inner side .... PHYLLOBÆNINÆ.
    2. Eyes entire or very slightly emarginate.... HYDNOCERINÆ.
II. Tarsi 4-jointed: pronotum separated from the parapleuræ by a more or less distinct margin.
  i. Antennæ serrate, or with three very large terminal joints......................... ENOPLIINÆ.
  ii. Antennæ with a smaller 3-jointed club ...... CORYNETINÆ.

Mr. C. J. Gahan in his paper "Notes on CLERIDÆ" which has recently appeared in the Annals & Magazine of Natural History (ser. 8, vol. v, January 1910, pp. 55–76) points out that, although Lacordaire's main divisions as given above are correct, yet the distinction between them is not quite accurately stated. As a matter of fact, all the CLERIDÆ, with scarcely an exception, have the tarsi 5-jointed, but in many genera the fourth joint is very small, and in many cases has been quite lost sight of, in consequence of which not a few genera of CLERIDÆ have been placed in a wrong subfamily. The distinctions should therefore be "tarsi distinctly 5-jointed" and "tarsi apparently 4-jointed."

Mr. Gahan discusses at length the relative importance of the character afforded by the presence or absence of a lateral margin on the prothorax, and disagrees with Prof. Lameere's conclusion that "the CORYNETINÆ having retained the lateral margin of the prothorax cannot be descended from the CLERINÆ which have lost it; on the other hand, the latter cannot be derived from the

CORYNETINÆ, since they still possess a well-developed fourth joint in the tarsi." He believes (on other grounds than those stated by Lameere) that it is highly improbable that the CLERINÆ are derived from the CORYNETINÆ, but sees no reason why the latter should not be derived from the former. He further is inclined to accept Lameere's suggestion that the CLERINÆ, CORYNETINÆ, and MELYRIDÆ should constitute a single family. Certain of the genera at present placed under the PHYLLOBÆNINÆ and four genera now standing under the CLERINÆ will have to be transferred to the CORYNETINÆ, and several alterations will have to be made in the other subfamilies.

The ENOPLIINÆ are remarkable as displaying to a greater extent than any other known group of the same size the phenomena of mimicry. Within its limits, as Mr. Gahan points out, are comprised the exact counterparts of other Coleoptera belonging to the LYCINÆ, LAMPYRINÆ, CANTHARINÆ, CISTELIDÆ, CHRYSOMELINÆ, GALERUCINÆ and COCCINELLIDÆ.

Family 62. LYMEXYLONIDÆ.

Form elongate; antennæ inserted at the sides of the head, eleven-jointed, more or less serrate; maxillary palpi in the male usually strongly developed and flabellate; pronotum short; anterior and intermediate coxæ large and prominent, conical; elytra usually covering or nearly covering the abdomen (much abbreviated and rudimentary in Atractocerus); *abdomen with five to eight visible ventral segments; legs slender; tarsi filiform, five-jointed; integument soft.*

This remarkable family contains about thirty species, which are widely distributed throughout the greater part of the world. In spite of their very soft bodies the larvæ of the LYMEXYLONIDÆ can bore into hard wood and have at times done much damage to timber. *Lymexylon navale* obtained its name from the injury it was found to be doing to ships, Linnæus having been commissioned by the King of Sweden to enquire into the ravages of the insect in his dockyards. Several of the species are remarkable for the extraordinary development of the maxillary palpi.

The larvæ of *Lymexylon* and *Hylecœtus* have been figured by Westwood (Classif. i, p. 269, figs. 19, 23, 30); they are very peculiar in appearance, the prothoracic segment being much raised and enlarged, and the last segment being furnished in *Hylecœtus* with a long pointed setose process, and in *Lymexylon* with a large half-upright obtuse lobe.

The most curious member of the family is, perhaps, *Atractocerus* (of which two or three species have been described from Ceylon). It has rudimentary elytra and large ample wings which are not folded and have a longitudinal venation, which is peculiar, but is nearer to that of the **Staphylinoidea** than of either of the other groups; there are eight visible ventral segments of the abdomen.

The remarks of Lameere (Ann. Soc. Ent. Belgique, ix, 1900, p. 358) with regard to the family are worth quoting:—

> "1. Of all the Coleoptera the family of the **Lymexylides** is the nearest to the ancestral Neuroptera.
>
> 2. Like the Planipennia, the **Lymexylides** have all the coxæ conical and projecting; their tarsi and their antennæ are not or hardly differentiated; in *Atractocerus* there are eight visible ventral segments of the abdomen, the maximum number found among the Coleoptera; *Hylecœtus* possesses the rudiment of the medial ocellus of the ancestral Neuroptera.
>
> 3. Like all survivors of primitive forms, the **Lymexylides** present very pronounced cœnogenetic characters, as, for example, the development of the maxillary palpi in the male."

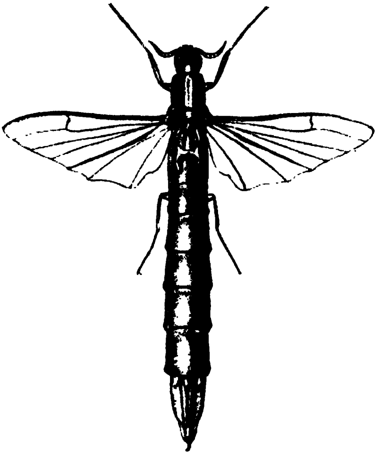

Fig. 62.—*Atractocerus frontalis.*

In his subsequent "Nouvelles notes pour la Classification des Coléoptères" (Ann. Soc. Ent. Belg. 1903, p. 159) M. Lameere disclaims having regarded *Atractocerus* as the lowest of the Coleoptera, but he certainly seems to do so in the above-quoted passage.

Family 63. ANOBIIDÆ (PTINIDÆ).

Form very variable, often different in the sexes, globular or cylindrical; antennæ nine- to eleven-jointed; anterior and middle coxæ cylindrical or globose, small, the former slightly prominent; posterior coxæ transverse and somewhat variable, not prominent abdomen with five visible ventral segments, of equal length; elytra covering the abdomen, with distinct and sometimes broad epipleuræ; pronotum very short; tarsi five-jointed, with the first joint not reduced or obsolete (as in the BOSTRYCHIDÆ), *sometimes even longer than the second.*

Some authors regard the PTINIDÆ and ANOBIIDÆ as distinct families, but at present they are best regarded as belonging to one only. Our knowledge of the whole group is exceedingly limited, and, as Sharp remarks, it is probable that we do not know more than the fiftieth part of the existing species, most of which lead lives that render them very difficult to find. Many of the species are very destructive, not only to wood, in which the majority live, but also to farinaceous substances and various kinds of dried provisions, etc. *Ptinus fur* is injurious to Natural History collections; it is said also to feed on old woollen clothes and appears to be almost omnivorous. *Anobium striatum* is the "Death Watch" of many authors; the clicking noise caused by the insect, which has given rise to the superstitions connected with it, and which is produced by other members of the family, is really a sexual call, and is produced by striking the jaws upon the wood on which the insects are standing *. Some of the larger species of ANOBIIDÆ occasionally do great damage to buildings by honeycombing the rafters, and old roofs are sometimes almost entirely destroyed by them †; some of the smaller species are very destructive to furniture. *Anobium paniceum* is the chief of the "biscuit-weevils" so notorious among sailors, although certain species of *Calandra* are also offenders in attacking biscuits.

The larvæ are small fleshy grubs, with the body curved, and resemble in miniature the larvæ of the LAMELLICORNIA; the antennæ are very short, and the legs short but well marked; there are no anal appendages or cerci.

From the nature of their food and habits many of the species have been very widely distributed, and a few are almost cosmopolitan. Between 400 and 500 species are known, but very few have been recorded as yet from India; representatives of *Ptinus*, *Anobium*, and *Ptilinus* have been found in Ceylon.

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* The question will be found discussed at length in my "Coleoptera of the British Islands," iv, pp. 186-7.

† I have had wood sent me from rafters of Arundel Church, Sussex, almost completely destroyed by *Xestobium tessellatum*.

Westwood (Thes. Ent. Oxon. plate iii, figs. 1–6) gives beautiful figures of the extraordinary genera *Polyplocotes*, *Diplocotes*, and *Ectrephes*, which are now regarded by some writers as forming a separate family: the latter genus, in the formation of its antennæ, resembles the PAUSSIDÆ, but Westwood is probably right in considering that the genus *Polyplocotes* solves the question of the real affinity of *Ectrephes* with the PTININÆ.

Family 64. BOSTRYCHIDÆ.

Form cylindrical; head usually deflexed and covered by the front of the pronotum, which is hood-shaped; antennæ distant, inserted immediately in front of the eyes, with a three-jointed club; anterior coxæ prominent, globose or slightly conical; anterior coxal cavities open behind; abdomen with five visible ventral segments, of equal length; tarsi five-jointed, with the first joint very small, often more or less obsolete; tibial spurs distinct.

The constitution of this family has been much disputed; it is considered by some to include the LYCTIDÆ, and by others the CIOIDÆ are regarded as merely a feeble and degenerate form of the BOSTRYCHIDÆ; the latter view is very probably correct, as, although the 4-jointed tarsi of the CIOIDÆ may be urged in objection, yet it must be remembered that the first joint of the tarsi is very small and sometimes obsolete in BOSTRYCHIDÆ, and might be expected to disappear in the degenerate forms at the end of the family. Some writers again include the BOSTRYCHIDÆ under the ANOBIIDÆ as a subfamily, but they are best separated, although they bear a strong relationship to the last-mentioned family.

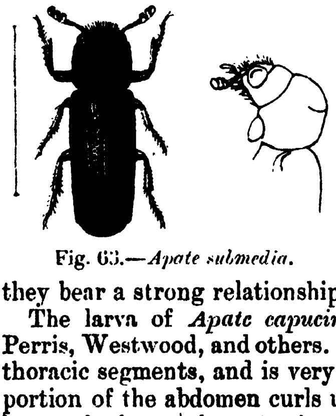

Fig. 63.—*Apate submedia.*

The larva of *Apate capucina* has been figured by Ratzeburg, Perris, Westwood, and others. It has a very small head and broad thoracic segments, and is very much narrowed behind; the apical portion of the abdomen curls up under the body, and the legs are long; the latter character is very important as it plainly separates the family from the SCOLYTIDÆ, with which several writers have associated it. The latter family possesses legless larvæ. In the characters of the larva, and, to a certain extent of the perfect insect, the BOSTRYCHIDÆ are, as I have before observed (Col. Brit. Islands, iv, p. 199), more closely related to *Sinodendron* than to the SCOLYTIDÆ. On the whole, however, their place is near the ANOBIIDÆ, although their relations to other groups are very evident.

Upwards of 180 species of the family are known; they are very widely distributed over the greater part of the world, but very few have been recorded from India, although three or four genera are represented. The species vary very considerably in size. Sharp says that the Californian species *Dinapate wrightii*, which has a larva very similar to that of *Apate capucina*, and is found feeding in stems of a species of Yucca, attains a length of nearly two inches, and he also says that some of the species "stridulate in a manner peculiar to themselves, by rubbing the front legs against some projections at the hind angle of the prothorax." As a rule the species feed in dry wood, to which they sometimes do great damage.

Family 65. LYCTIDÆ.

Closely allied to the BOSTRYCHIDÆ, *but distinguished by having the club of the antennæ distinctly two-jointed, and the first visible ventral segment of the abdomen elongate, and also by the fact that the anterior coxal cavities are closed behind; form elongate and narrow; posterior coxæ widely separated; tarsi five-jointed, with the first joint very short or obsolete; tibial spurs distinct.*

The members of the family are small elongate insects that are found in and about wood which has been freshly cut, or in old stumps, etc. They are few in number, but are very widely distributed; two or three species of *Lyctus* have been recorded from Ceylon.

The LYCTIDÆ are often regarded as a subfamily of the BOSTRYCHIDÆ, and they are certainly closely related to the latter family. The larvæ are very similar, being in both cases broad in front and narrowed behind, and having a very small head. Lameere (Ann. Soc. Ent. Belg. ix, 1900, p. 359) is of opinion that the structure of the larva is a decisive argument for placing them together, and believes that they have a common ancestor and are not descended the one from the other. Leconte and Horn, Sharp, and others consider them to be too nearly related to be separated, and the genus *Dinoderus* is somewhat intermediate; but the differentiating characters seem as important as those which separate other families, and it seems preferable to keep them distinct for the present.

[Family 66. SPHINDIDÆ.]

Minute insects of oblong or globular form; antennæ inserted in front of the eyes, ten-jointed, with the first two joints thickened and the last joints forming an elongate club as long as the basal portion;

anterior coxæ transverse, contiguous or subcontiguous, posterior coxæ transverse or semiovate, widely distant; elytra entire; tarsi apparently heteromerous (5, 5, 4)*; abdomen with five free ventral segments, the first the largest.*

This family is regarded as including *Aspidiphorus* (*Conipora*), and although the position of its members is doubtful, as they have relations towards the Clavicorn series, yet they appear to be best placed near the CIOIDÆ, from which they differ in the tarsi being 5-jointed, at any rate the anterior and intermediate pairs; the number of joints possessed by the posterior pair is somewhat doubtful, but is usually regarded as four, the first being obsolete. They are small insects and are found in powdery fungi on and under the bark of trees. Their larvæ are of the ordinary elongate form, with very short antennæ and legs, and hairs at the sides of the segments; there are no cerci. The pupa of *Sphindus dubius* is remarkable as bearing a long narrow process like a tail.

I. Anterior coxal cavities plainly open behind; form subglobular .... ASPIDIPHORINÆ.
II. Anterior coxal cavities lightly closed behind; form oblong.............................. SPHINDINÆ.

These two groups have been widely separated as families, but, as they are only found in Europe and North America, the question need not here be discussed at length. The former certainly bears strong affinities towards the BYRRHIDÆ, while the latter is related to the LYCTIDÆ; and Perris (who points out the resemblance of their larvæ) regards them as allied to the fungivorous SILPHIDÆ and LATHRIDIIDÆ. Although we have before considered them as distinct *, yet we prefer now to adopt Dr. Sharp's view and place them as one family near the CIOIDÆ.

Family 67. CIOIDÆ.

Minute insects of oblong and more or less cylindrical form; antennæ inserted at the interior margin of the eyes, eight- to ten-jointed, with the last three joints thicker and forming a loose club; head and anterior margin of the pronotum sometimes furnished with short horns or raised plates, especially in the males; anterior and middle coxæ small, oval, not prominent; anterior coxal cavities small, narrowly closed behind; elytra covering the abdomen; legs rather short, tibiæ variable in breadth, tarsi four-jointed, claws simple; abdomen with five free ventral segments.

About 300 species are known, which are very widely distributed, though very few have been described from the Indian region*. The genus *Cis* is spread over the chief part of the world, and two or three species have been recorded from Ceylon. Candèze also has described a genus *Pterogenius* from the same island. The members of the family are found in fungi or old wood, or in decayed wood affected by fungoid growths; they are very gregarious, and may be found occasionally in hundreds in a single large fungus.

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* 'Coleoptera of the British Islands,' iii, p. 373, and iv, p. 203.

The larvæ are elongate, cylindrical, fleshy grubs, with short antennæ and moderately long legs, and the segments are of much the same character except the last which bears two longer or shorter hooks or spines, which are somewhat recurved towards the back; underneath these at the base there is a protuberance which is really the basal process or proleg. The pupæ also are furnished at the apex with the same sort of spines; in *Cis mellyi*, and probably in other species, the spines in the larva are replaced by a broad chitinous tube, but the pupa terminates in the normal hooks.

The family has usually been placed near the BOSTRYCHIDÆ, and has been even regarded as a lower form of this family. Dr. Sharp, however, is inclined to refer them to a position near the COLYDIIDÆ and CRYPTOPHAGIDÆ, and in their 4-jointed tarsi and also in the formation of the front and middle coxæ they certainly agree with the former of these families. Their real position cannot, however, be said to have been completely settled.

Family 68. BUPRESTIDÆ.

Head very short, vertical, inserted into the prothorax as far as the eyes; antennæ inserted on the front, short, nearly always serrate, eleven-jointed; anterior and middle coxæ globular, with distinct trochantins; anterior coxal cavities widely open behind; posterior coxæ transverse; prosternum prolonged into a process behind, which fits into the mesosternum; abdomen with five ventral segments, the first two connate; legs short, tarsi five-jointed, joints one to four with more or less developed membranous appendages beneath. Very conspicuous insects, in most cases, and often very brilliantly metallic.

Lacordaire (1857) states that 1200 species belonging to the family were known in his time, but they have, owing to their conspicuous coloration, been largely collected, and at the present time about 5000 species have been described. A large number of the species are amongst the most brilliantly metallic of all insects, and they are in many cases used as articles of jewellery, with appropriate settings, while the elytra of some of them have been extensively used for the embroidery of dresses, ornamental tablecloths, etc., by natives of India and other countries. Owing no doubt to the hardness of their integument, remains of these insects are very abundant in certain geological strata.

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* In Mellié's well known "Monographie de l'ancien genre *Cis*" (Ann. Soc. Ent. France, 1848, p. 245 etc.) not a single species is recorded from India or Ceylon.

Certain genera are very sombrely coloured on the upper surface, but extremely brilliant beneath; as a rule, however, both the surfaces are brightly coloured, the underside being more golden and fiery, while the upper side is more often green or golden-green. Many of the species are quite smooth, while others are very strongly and deeply sculptured (e. g. *Stigmodera gratiosa*, Gory). Some of the genera of the BUPRESTIDÆ are very large; *Agrilus*, for instance, comprises more than 650 species; the Australian genus *Stigmodera*, and the widely distributed Old-World genus *Sphenoptera* have about 300 each; while *Acmæodera* and *Chrysobothris* are not far behind these.

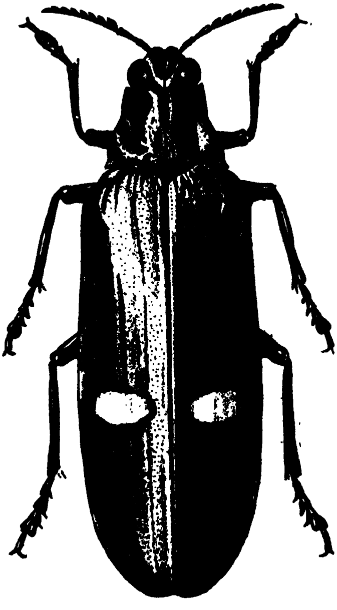

Fig. 64.—*Catoxantha bicolor*. (Natural size.)

The prosternal process is very strongly developed in some of the BUPRESTIDÆ, but they have not, apparently, any power of leaping, like the ELATERIDÆ.

The larvæ are remarkable for the great development of the thoracic segments, especially the first, which presents the appearance of a large head; the real head, however, is very small [*], and

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[*] It has, however, been pointed out by Dr. Sharp and others that the morphology of the head and front parts of the Buprestid larvæ is not yet fully understood, and that the aid of embryology is necessary to settle the point.

is retractile within the prothorax; the antennæ are extremely short, and there are no ocelli; the legs are rudimentary or absent; the mandibles are short, hard, and toothed, and so fitted for gnawing galleries in the wood in which they live; the abdominal segments are nine in number, and the anal process projects and looks like a tenth segment. The larvæ are mostly found in wood,

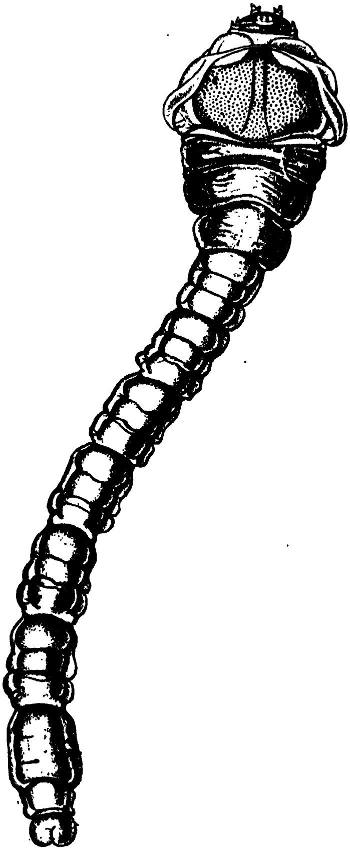

Fig. 65.—*Euchroma columbicum* larva. (Natural size.—After Schiödte.)

but some are, apparently, herbivorous. Like many other wood-feeding species, they have, in numerous instances, been carried from one country to another, and been wrongly considered as indigenous: the old stories, however, of their emerging in the perfect state from articles of furniture in a country quite foreign to them after an interval of as much as twenty years, certainly require further confirmation.

The Buprestidæ are very widely distributed, but are very scarce in temperate climates, and all the large and more brilliant forms are confined to the hottest tropical countries. They are slow on their feet, but extremely active on the wing, and either fly off or drop into the herbage beneath instantaneously, on the slightest approach of danger.

The chief authority on the group is M. Kerremans, who has done much valuable work during the past few years. The following is the classification of the family which he adopts (Wytsman's "Genera Insectorum"); it is almost entirely based on Lacordaire's more detailed and less concise classification (Gen. Coléopt. iv, pp. 10–89).

I. Median coxal cavity formed entirely by the mesosternum (except in certain South African species of *Julodis* and *Amblysterna*).
  1. Antennal pores scattered over the two faces of the serrate joints *.
    i. Posterior coxæ slightly dilated on their inner side, their posterior margin transverse and slightly sinuate; scutellum invisible; antennal pores hidden by silky pubescence .... Julodinæ.
    ii. Posterior coxæ distinctly dilated on their inner side, their posterior margin oblique; antennal pores bare.................. Thrincopyginæ.
  2. Antennal pores concentrated in a depression or fovea on the serrate joints.
    i. Lateral pieces of the metathorax narrow . Polycestinæ.
    ii. Lateral pieces of the metathorax very broad............................. Schizopinæ.
II. Median coxal cavity formed laterally by the mesosternum and at its posterior part by the metasternum.
  i. Lateral pieces of the mesosternum elongate (except in *Belionota*).
    1. Antennal pores scattered over the two faces of the serrate joints.
      A. Scutellum invisible .... Chrysochroinæ.
      B. Scutellum visible .... Chalcophorinæ.
    2. Antennal pores concentrated in a depression or fovea on the serrate joints.
      A. Front not narrowed at the insertion of the antennæ; eyes not very close together, sometimes distant on the vertex.
        a. Scutellum broad and acuminate behind; mentum large, triangular; poriferous foveæ terminal......... Sphenopterinæ.

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* They are also present, at any rate in many cases, on the basal cylindrical joints as well.

b. Scutellum at most moderate, never enlarged in front or acuminate behind; mentum strongly transverse; poriferous foveæ terminal or inferior.......................... BUPRESTINÆ.

B. Front narrowed at the insertion of the antennæ; eyes strongly oblique and closely approaching one another on the upper surface .... CHRYSOBOTHRINÆ.

ii. Lateral branches of the mesosternum very short and set back on the sides, or invisible.

1. Front narrowed at the insertion of the antennæ; antennal cavities very large and situated at a considerable distance from the eyes; posterior coxæ not dilated on their inner side, with their posterior margins horizontal and slightly sinuate; poriferous foveæ terminal.

A. Base of pronotum more or less sinuate. AGRILINÆ.

B. Base of pronotum straight .... MASTOGENINÆ.

2. Front not narrowed at the insertion of the antennæ; antennal cavities moderate and situated near the eyes; posterior coxæ dilated on their inner side, their posterior margin oblique; poriferous foveæ variable..................... STIGMODERINÆ.

A very considerable number of genera are represented in India, some of them being, through their bright and conspicuous appearance, very well known even to the casual observer.

Family 69. ELATERIDÆ.

Antennæ inserted on the front in grooves, or under the margin of the front, serrate, pectinate or filiform; prothorax with the posterior angles usually produced, sometimes strongly so; prosternum with a process behind, received into a cavity of the mesosternum; anterior coxal cavities open behind, but entirely prosternal; legs short, often retractile; tarsi five-jointed, simple or lobed beneath, claws simple, toothed or pectinate; posterior coxæ with a plate partly or completely covering the femora (except in the Cerophytinæ*); abdomen with five (rarely six) visible segments, the terminal one only being feebly moveable.*

A satisfactory classification of this group has been regarded by some of the chief authors as almost hopeless *. Lacordaire and others consider the Throscidæ, Eucnemidæ, Elateridæ, Cerophytidæ, and Cebrionidæ as distinct families; while others prefer to range them all as subfamilies under the Elateridæ. The Throscidæ ought perhaps to be separated from the rest by reason of the formation of the anterior coxal cavities and by the close articulation of the prothorax and mesothorax, but the others run very much into each other and may be classed together. If the larvæ are considered, however, there are further difficulties in the way, that of *Cebrio* especially differing from the others, although the larvæ of the Eucneminæ are hardly less peculiar in some cases. The table given by Leconte and Horn ('Classification of the Coleoptera of North America,' p. 176) is perhaps as good as any other, and it is the one quoted by Dr. Sharp ('Cambridge Natural History,' vol. vi. p. 260), but it deals only with the perfect insects and is not altogether satisfactory:—

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* Lacordaire (Hist. Nat. Ins. iv, p. 136), in speaking of this says that difficulties of classification are usually caused by the great homogeneity of the species; in the ELATERIDÆ, on the contrary, they arise from the extreme variability of all the organs (except those of the mouth) added to a general form which is only modified within very narrow limits.

I. Posterior coxæ laminate; trochanters small.
  i. Labrum concealed; antennæ somewhat distant from the eyes, their insertion narrowing the front .... Eucneminæ.
  ii. Labrum visible, free; antennæ arising near the eyes under the frontal margins .... Elaterinæ.
  iii. Labrum transverse, connate with the front.
    1. Six ventral segments; claws simple; tibial spurs well developed .... Cebrioninæ.
    2. Five ventral segments; claws serrate; tibial spurs moderate .... Perothopinæ.
II. Posterior coxæ not laminate; trochanters of middle and posterior legs very long .... Cerophytinæ.

These subfamilies are very uneven in point of numbers, two of them, the Perothopinæ and the Cerophytinæ, consisting of only one genus each. *Perothops* has usually been included under the Eucneminæ and might perhaps still be left in that position, but *Cerophytum* is distinct by reason of the non-laminate hind coxæ and the long trochanters of the middle and posterior pairs of legs. The former of these genera appears to be a link between the Eucneminæ and the Cebrioninæ, while the latter has been considered to have some affinities towards the Dascillidæ, which perhaps are more apparent than real.

Most of the Elaterinæ and some of the Eucneminæ possess the power of jerking themselves into the air with a sharp click if placed on their backs; hence the term "click-beetles" and the generic name *Elater* or "springer." This movement is brought about by raising the prosternum until the end of the posterior process rests against the edge of the mesosternum; on being suddenly released the process slips forcibly into the mesosternal cavity and by the sudden jerk the base of the elytra is made to strike the surface on which the insect is resting, and this, with the elasticity of the body, causes it to fly upwards.

The EUCNEMINÆ are chiefly remarkable for their larvæ, which are legless; they have been supposed to be carnivorous, but this is certainly not the case, as it is difficult to find any mouth-opening at all in some of them. They probably live on the juices of the decayed wood in which they are found. The larva of *Eucnemis capucina* possesses no rudiments of legs and no ocelli, and the mouth, palpi, and antennæ are rudimentary and scarcely traceable; the head is armed on its front margin with very hard saw-like teeth with which it probably makes its burrow in the soft wood in which it lives.

The ELATERINÆ are, for the most part, sombre-coloured insects, but some are conspicuous for their brilliant red or (more rarely) metallic coloration. The most remarkable members of the group, which have been known and commented upon for centuries, are the so-called "fire-flies" which belong to the genus *Pyrophorus*. These are, apparently, confined to tropical America and are not found in the Old World.

The larvæ of the ELATERINÆ are well known as destructive to vegetation and especially corn crops. They are cylindrical and very tough-skinned, and thus obtain the name of "wire-worms"*; the head is without ocelli, and the thoracic and abdominal segments are of the same breadth, the prothoracic segment being the longest; the last segment is variable, being sinuate or dentate at the sides and with the apex simple or split into dentate processes; the legs are short but distinct.

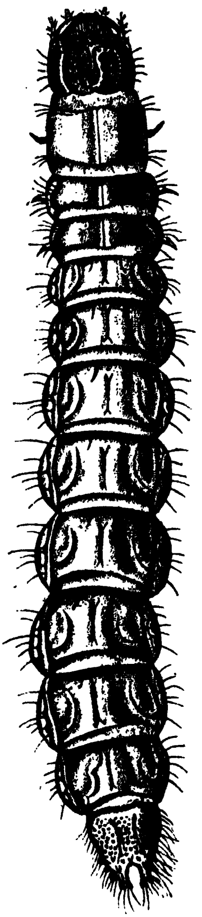

Fig. 66.—*Alaus myops*. Larva × 3. (After Schiödte.)

Most of the larvæ of the group bear a strong family resemblance to one another; they are not, however, all vegetable feeders, as many are found in decaying wood, and some are carnivorous, and will even feed on one another (*e. g.* the larva of *Athous rhombeus*).

Some of the very large species, like *Alaus*, have large eye-like markings on the pronotum, which are considered by some writers to be scare-organs, but this hardly seems probable.

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* The Myriapod, *Julus*, is also called, by the British agriculturist, the "wire-worm."

The CEBRIONINÆ, at first sight, are quite distinct from the rest of the ELATERIDÆ and have for long been considered as a separate family. *Cebrio gigas* is, superficially, more like a Lamellicorn than an Elaterid. Lacordaire defines the subfamily however as being ELATERIDÆ without the power of leaping and with the legs formed for digging, and this sums up their leading characteristics. They are very abnormal in their habits. The earlier stages of *C. gigas* are passed in the ground, from which the males emerge in large numbers, at a certain period in damp weather; while the females, which are wingless, remain in the ground, near the surface, protruding only the posterior portion of the body, and in this position are fertilised by the males. The latter have their surface pubescent, while the females are glabrous, or nearly so, as might be expected from their manner of life. The larvæ have much in common with those of the ELATERINÆ, but differ in several respects, notably in the atrophied first legs, the form of the prothorax, and the absence of any anal process.

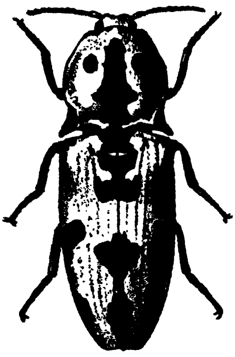

Fig. 67.—*Alaus speciosus.* (Natural size.)

The ELATERIDÆ are widely distributed throughout the world, and are well represented in India by about fifty or sixty genera, which belong almost entirely to the ELATERINÆ; there are very few EUCNEMINÆ, and the other groups are not represented. Several European genera occur, among them *Lacon*, *Megapenthes*, *Elater*, *Cardiophorus*, *Melanotus*, and *Athous*; among the most conspicuous Indian species are those belonging to *Camposternus* and *Alaus*.

Family 70. THROSCIDÆ.

Antennæ inserted on the front, received in grooves beneath, eleven-jointed, sometimes serrate, sometimes with a loose three-jointed club; prosternum with an anterior lobe protecting the mouth, and with a flat process behind which is received into the mesosternum; prothorax closely articulated with the mesothorax; anterior and middle coxæ small, anterior coxal cavities open behind, the coxæ being enclosed by the prosternum and the mesosternum; elytra entirely covering the abdomen; abdomen with five visible ventral segments, closely connected, but not connate; legs short, retractile, tarsi five-jointed, one or more of these joints being furnished beneath with a membranous lobe.

This is a small family, containing some half-dozen genera and from 100 to 150 species; they are very small and inconspicuous insects, and are found by sweeping herbage or flowers, at the roots of grass, in moss, on or about dead wood, etc. Nothing much appears to be known about their life-history. They have been classed by some authors with the ELATERIDÆ and EUCNEMIDÆ, but differ in the fact that the prothorax is firmly articulated with the mesothorax and not loosely as in these latter families, and also in the formation of the anterior coxal cavities; the species, moreover, have not apparently the power of leaping, if laid on their backs. Gyllenhal (Insec. Suec. i. p. 159) expressly says they can jump like the *Elateres*, and other authors claim to have observed this, but the truth is still uncertain, and the structure of the prosternum seems to prove that no leaping power is possessed by the family.

The species are mostly found in Europe and America, and very few have been described from India; *Throscus*, *Lissomus*, and *Drapetes* are represented by one or two species each, but very few others have been discovered in the region.

Division 4. HETEROMERA.

This division, as its name implies, is characterised by the fact that the number of joints in the tarsi vary, those of the hind tarsi being less than those of the two anterior pairs. In an aberrant Old-World genus, *Heterotarsus*, the joints are 4, 4, 3 respectively, but in the others they are 5, 5, 4, with the single exception of *Mophon tinctipennis* which has 4-jointed anterior tarsi in the male. A few members of the old Clavicorn series, such as *Anisotoma*, *Acritus*, and *Rhizophagus*, have the hind tarsi 4-jointed in one or both sexes, and these might perhaps be included under the HETEROMERA proper with as good reason as some of the species now recognised as belonging to the group.

In the Munich Catalogue (1870) 6827 species are enumerated, but these have now been increased to 15,000. This is largely due to Mr. G. C. Champion, who has done so much valuable work both on this and other groups of the Coleoptera, and to whom I am indebted for much information and kind assistance. The great majority (almost two-thirds) belong to the TENEBRIONIDÆ, and the rest are at present placed under some sixteen or seventeen families, the value of several of these being extremely doubtful. The TENEBRIONIDÆ, LAGRIIDÆ, and CISTELIDÆ with their closed coxal cavities, may perhaps be considered a natural group, but a large proportion of the rest have little, if any, connection with one another, and might in some cases be, with reason, assigned to other groups, of which they are at present regarded as mimics.

The Heteromerous genera comprise a greater variety of forms than any other of the more important Coleopterous series, and their chief peculiarity lies in the fact that they reproduce nearly all the most characteristic forms of these series. It is difficult to find any satisfactory explanation for this.

Concerning these resemblances, Mr. Champion (Biologia Centrali-Americana, Col. iv. Part 1, Introduction, p. v) writes as follows:—"As examples of this assimilation, the following genera are especially noteworthy, viz.:—*Statira* (LAGRIIDÆ) to various CARABIDÆ (*Agra*, *Calleida*, etc.); *Cuphotes* (=*Spheniscus*) to *Cypherotylus* (EROTYLIDÆ); *Doliema* (TENEBRIONIDÆ) to various CUCUJIDÆ; *Uroplatopsis* (LAGRIIDÆ) to various HISPIDÆ (*Uroplata*) and LYCINÆ; *Calopus* (ŒDEMERIDÆ) to various LONGICORNIA; *Othnius* to various CLERIDÆ; *Phrenapates* (TENEBRIONIDÆ) to various PASSALIDÆ; *Hapsida*, *Nautes*, and *Gonospa* to various CHRYSOMELIDÆ; *Diplectrus* (ŒDEMERIDÆ) to *Chauliognathus* (TELEPHORIDÆ); *Sisenes* (ŒDEMERIDÆ) to various CANTHARIDÆ; *Nilio* to various COCCINELLIDÆ and ENDOMYCHIDÆ; *Zypætes* (TENEBRIONIDÆ) to *Epierus* (HISTERIDÆ); *Paratenetus* (TENEBRIONIDÆ) to various CRYPTOPHAGIDÆ (*Cryptophagus* and *Corticaria*). Probably no better cases of so-called 'mimicry' or homochroism can be found amongst the Coleoptera than exist between certain species of *Cuphotes* and *Cypherotylus* and between *Uroplatopsis* (*U. mimica*) and *Uroplata* (*U. dimidiata*)." This list might be almost indefinitely extended; most of us who have worked at any groups have had to be careful to exclude HETEROMERA from batches of beetles received from superficial observers, and even in the best Museums, mistakes are not unknown. Mr. Champion has not called attention to the fact which I have before noticed*, that the two groups of beetles in which mimicking species are most often found are the LONGICORNIA and the HETEROMERA, but that, although in the former resemblances to other orders of insects (more especially Hymenoptera) are often found, in the latter these are conspicuously absent, almost the only exceptions being the genera *Anthicus* and *Formicomus*, which imitate ants. It is hard to explain this fact, which will be again referred to under the LONGICORNIA †.

The larvæ, as pointed out by Dr. Sharp and others, fall into three groups:—

1. Form regularly cylindrical; integument hard; legs distinct; no pseudopod or tubercle present, except at the extreme apex, where one or two short warty prominences are usually visible.

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* Presidential Addresses before the Entomological Society of London, 1902, p. 26; 1903, p. 16.

† [The Longicorns which mimic Hymenoptera are mostly quick-flying, flower-frequenting species which consort much with the bees and wasps that visit flowers. Species having such habits are relatively very rare among the Heteromera, so that we should naturally expect that mimicry of Hymenoptera would be quite exceptional in the group.—G. A. K. M.]

2. Form elongate and cylindrical, but outline uneven; integument softer; legs distinct; in many cases pseudopods or tubercles present on both the dorsal and ventral surfaces.
3. Larvæ active in their first stage, with long legs, living on the bodies of other insects (triungulins); quiescent and inactive, with short legs, in their second stage.

The larvæ of the TENEBRIONIDÆ, which very closely resemble one another, belong almost entirely to the first group; the ŒDEMERIDÆ are examples of the second; while the MELOÏDÆ afford varying and striking examples of the third; to one or two of these reference has already been made (pp. 32, 33).

The larva of *Trictenotoma* has only recently been discovered, and may perhaps be considered as the type of a fourth group.

The majority of writers consider the HETEROMERA to be a very heterogeneous division, and it certainly appears to be so; there is, however, a sort of indefinable facies about a heteromerous beetle, which, in most cases, enables any expert at the Coleoptera to recognise it almost at the first glance, and this is somewhat of a proof that the group is more homogeneous than is usually thought to be the case. Lameere (Ann. Soc. Ent. Belg. ix, 1900, p. 370) is of opinion that it forms a perfect systematic unity, and that its "coryphées" or primary members are to be looked for in *Trictenotoma* and *Phrenapates*. He reduces the group, moreover, to three families only: TENEBRIONIDÆ, MELANDRYIDÆ, and LAGRIIDÆ. The MELANDRYIDÆ, according to his arrangement, include, besides the genus *Melandrya* and its allies, the MORDELLIDÆ, the RHIPIPHORIDÆ (which are only specialised MORDELLIDÆ), and the STYLOPIDÆ (which are only superior RHIPIPHORIDÆ); the LAGRIIDÆ include, besides *Lagria* and its allies, the PYTHIDÆ, PYROCHROIDÆ, MELOÏDÆ, ŒDEMERIDÆ, and ANTHICIDÆ. It is very doubtful, however, whether these latter can be regarded (as stated by Lameere) as having detached themselves independently from the LAGRIIDÆ.

Key to the Indian Families.

I. Anterior coxal cavities closed behind.
  i. Tarsal claws simple.
    1. Abdomen with five ventral segments, of which the first three are more or less closely connected.
      A. Anterior coxæ globose, rarely oval, not prominent; penultimate joint of tarsi very rarely bilobed and spongy pubescent beneath ...... **Tenebrionidæ**, p. 159.
      B. Anterior coxæ conical or conical-ovate, prominent; penultimate joint of tarsi bilobed and spongy pubescent beneath (except in one or two genera)............... **Lagriidæ**, p. 161.
    2. Abdomen with five free ventral segments .... **Othniidæ**, p. 162.

ii. Tarsal claws pectinate .... **Cistelidæ**, p. 163.
II. Anterior coxal cavities open behind.
i. Prothorax without sharply produced or strongly dentate margins; size moderate or small.
1. Head not strongly and suddenly constricted at base.
A. Middle coxæ not very prominent; antennæ received into grooves on the prosternum .... **Monommidæ**, p. 163.
B. Middle coxæ very prominent; epipleuræ of elytra almost absent .. **Œdemeridæ**, p. 165.
2. Head strongly constricted at base.
A. Prothorax at base not narrower than base of elytra.
a. Lateral suture of prothorax distinct.
*a**. Posterior tibiæ as long as the tarsi; tarsal claws with a rudimentary tooth at base; penultimate joint of tarsi strongly bilobed .... **Scraptiidæ**, p. 167.
*b**. Posterior tibiæ shorter than the tarsi; tarsal claws usually plainly toothed; penultimate joint of tarsi simple ...... **Mordellidæ**, p. 167.
b. Lateral suture of prothorax obsolete .... **Rhipiphoridæ**, p. 168.
B. Prothorax at base plainly narrower than base of elytra.
a. Tarsal claws split from base to apex .... **Meloïdæ**, p. 170.
b. Tarsal claws not split.
*a**. Antennæ serrate, subpectinate, or ramose[1]; size comparatively large; head exserted, horizontal or almost horizontal .... **Pyrochroidæ**, p. 172.
*b**. Antennæ filiform or moniliform (very rarely flabellate); size very small; head deflexed.
a†. Penultimate joint of the tarsi minute, hidden within the lobes of the preceding joint, which is strongly bilobed; head constricted immediately behind the eyes, which are large .... **Xylophilidæ**, p. 173.
b†. Penultimate joint of tarsi not minute, bilobed; head constricted at some distance behind the eyes, which are moderate or small .... **Anthicidæ**, p. 173.

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[1] In one genus, *Ischalia*, from Borneo, they are almost filiform.

ii. Prothorax with the margins produced into sharp edges which are dentate; size very large; shape resembling that of a large Prionid (LONGICORNIA) .. **Trictenotomidæ**, p. 174.

Family 71. TENEBRIONIDÆ.

Form very variable; antennæ eleven- rarely ten-jointed, inserted laterally before the eyes under a frontal ridge; anterior coxæ globose, sometimes slightly transverse, coxal cavities closed behind; intermediate coxæ rounded, with or without trochantins, posterior coxæ transverse; elytra usually covering abdomen; abdomen with five ventral segments, of which the first three are more or less closely connected; tarsal joints not lobed beneath, claws simple.

In the Munich Catalogue (1870) 583 genera and 4222 species of TENEBRIONIDÆ are enumerated, and Mr. Champion in his Supplementary list (Mém. Soc. Ent. Belg. iii, 1895) enumerates 430 more genera and 5063 more species, so that the present number known must be well over 10,000. So far as the Indian fauna is concerned very little interest has been taken in the family[1] about 40 genera are represented in the Catalogue of Gemminger and von Harold, and between 30 and 40 in the Supplement, but the number of species is proportionally very small and does not amount to more than about 300; in fact, in the Supplement only some 70 or 80 species out of the 5000 are recorded as from India and Ceylon.

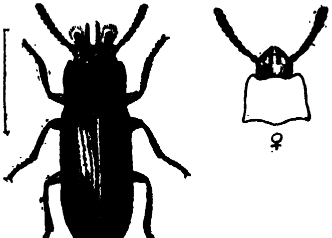

Fig. 68.—*Toxicum quadricorne*, male, and head and thorax of female.

Allusion has already been made to the larvæ, which are tough and cylindrical, and resemble the "wire-worms" of the ELATERIDÆ, the chief differences consisting in the non-connate clypeus, the large and plainly visible labrum, and the less complex terminal segment of the abdomen. The pupæ appear to be broad in proportion to the larvæ and to be furnished with extensions at the sides of the abdominal segments, and with longer or shorter robust cerci. Several of the larvæ and pupæ have been beautifully figured by Schiödte (De Metamorphosi Eleutheratorum, x, p. 532, pl. v–xii).

In both the larval and perfect state the members of the family live on vegetable matter in various conditions, but chiefly in a dry state, and many species are found among grain, some of them (e. g. *Tenebrio molitor*, or the "meal beetle") occasionally doing serious damage in granaries and stores; in consequence of this habit they are carried all over the world in grain-ships and are, therefore, in many cases, cosmopolitan.

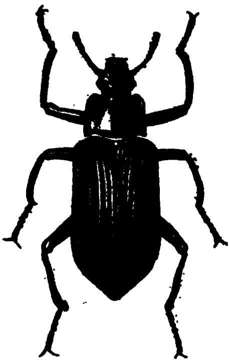

Fig. 69.—*Setenis valga.*

Some of the TENEBRIONIDÆ are large, black, and often repulsive looking insects (e.g. *Blaps, Ocnera, Tentyria,* and *Pimelia*). The latter are found in salt and sandy places and are sluggish insects, while others, of the same dark colours, run with great velocity; many have the elytra in part or entirely soldered together and are practically, if not absolutely, apterous; others, again, have large and ample wings, and some are brightly coloured. One of the strangest and most isolated genera of the family is *Cossyphus*, of which three or four species occur in India; they have the appearance of elongate CASSIDIDÆ. The species as a whole vary extremely in form, and it is hard to regard such insects as *Blaps gigas* and *Palorus depressus*, for instance, as belonging to the

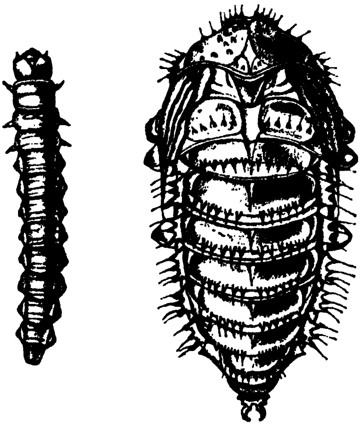

Fig. 70.—*Diaperis boleti.* Larva × 3. Pupa × 7. (After Schiödte.)

same family. The large majority of the species of the group are not interesting, and have, in consequence, been much neglected.

It is almost impossible to give a satisfactory table of the various groups, sections, and tribes belonging to this great and in many ways heterogeneous complex. Owing to the very large number of species that have been described of late years the older work of Lacordaire and others has become more or less obsolete, and the more modern writers have dealt only with their particular groups. The distinctive characters, moreover, are often slight and not very evident from descriptions. The student, however, can very easily become acquainted with the leading features and divisions of the family by looking over a collection, or even a good set of illustrations, as the facies of the various groups is very different. The similarity of the larvæ, however, is very striking, and it is this, more than anything else, that enables the family to be regarded as homogeneous in spite of the very variable aspect, habitat, and habits of its members.

[Family 72. ÆGIALITIDÆ.]

Head prominent; eyes small; antennæ eleven-jointed, inserted under very small oblique frontal ridges; anterior coxæ widely, intermediate and posterior coxæ very widely, separated; anterior coxal cavities closed behind; abdomen with six ventral segments, the tip of the sixth only being visible; tarsi, except the last joint, pubescent beneath, claws simple.

This small family contains only one or two species of small and very rare insects from Alaska and California, the position of which has given rise to many doubts. In the Munich Catalogue they are included under the TENEBRIONIDÆ; Mannerheim hesitated whether to place them with the SCYDMÆNIDÆ or near *Helops*; Dejean regarded *Ægialites* as near *Mastigus*; others again have considered it to be related to the DRYOPIDÆ; Sharp, who is probably right, appears to think that the family is closely allied to the PYTHIDÆ, from which it is distinguished by the minute, closed in, and deeply embedded anterior coxæ.

Family 73. LAGRIIDÆ.

Antennæ eleven-jointed, inserted under small frontal ridges; prothorax narrower than base of elytra, more or less cylindrical; elytra completely covering abdomen; anterior coxæ conical and prominent, cavities closed behind; intermediate coxæ with trochantin; posterior coxæ transverse; abdomen as a rule with five segments, a sixth some-

times visible; legs slender, claws simple, penultimate joint of tarsi with a thick brush of hairs beneath.

So far as the characters of the perfect insect go there seems no real reason why this family should be separated from the TENEBRIONIDÆ, and, according to Leconte and Horn, it is chiefly because of the difference in the larva that it is retained as distinct. Yet the only apparent distinction in the larva consists in its being somewhat broader and more active, while the pupa of *Lagria hirta* is very closely allied to that of several of the TENEBRIONIDÆ, except that the lateral dilatations of the abdominal segments are prolonged into sub-clavate processes. The family contains about 200 species of which the greater part belong to the genera *Lagria* and *Statira*; about half-a-dozen species of the former have been recorded from the Indian region. They are chiefly found on leaves of shrubs and the lower branches of trees, and under bark, and occur only rarely on flowers. The larvæ of some, at any rate, of the species hibernate under dead leaves and in refuse of dead wood at the foot of old trees.

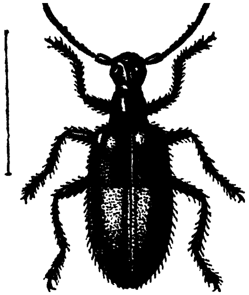

Fig. 71.—*Lagria basalis.*

Family 74. OTHNIIDÆ.

Antennæ inserted under the sides of the front, eleven-jointed, joints 9–11 forming a loose club; head large and flat; anterior coxæ small, conical, and contiguous, cavities closed behind; intermediate and posterior coxæ slightly separated, the former rounded, the latter transverse; apex of abdomen uncovered; abdomen with five visible segments, all free; legs slender; form elongate, integument weak.

This family contains a single genus, which was formerly (when one sex only was known) placed among the CLAVICORNIA near the MYCETOPHAGIDÆ. They are however heteromerous in both sexes, and according to Leconte and Horn (Classif. Col. North America, p. 392) "the margins of the ventral segments are semi-membranous as in the more degraded TENEBRIONIDÆ and the subsequent families." The antennæ, moreover, have sensory punctures similar to those observed in the HELOPINÆ. The insects are found running on the leaves of trees, and are probably predaceous. The genus is widely distributed, occurring in Borneo, New Guinea, Ceylon, Japan, and North and Central America, but no species has, as yet, been recorded from South America.

Family 75. CISTELIDÆ.

Closely allied to the TENEBRIONIDÆ, *from which they differ in having the tarsal claws pectinate; antennæ inserted under small frontal ridges, which are often almost obsolete; coxæ somewhat variable, anterior pair varying from globose and subtransverse to conical; coxal cavities closed behind; legs usually long, posterior tarsi with the first joint elongate and the penultimate often bilobed; abdomen with five (sometimes six) visible ventral segments, the first three being more or less closely connected.*

About 500 species of this family are known. The only rea point on which they can be separated from the TENEBRIONIDÆ is the pectination of the tarsal claws; the larvæ, however, very closely resemble those of the latter family; there seems, therefore, to be no strong reason for separating the families, and some authors have united them. Many of the species occur on flowers, and the larvæ are usually found in dead wood. A few genera (e.g. *Cistela*, *Allecula*, *Cistelomorpha*, etc.) are represented in India.

Family 76. MONOMMIDÆ.

Small oval insects; head horizontal, prominent; antennæ inserted under the frontal margin, and received in grooves on the underside of the prothorax, eleven-jointed, last three joints forming a club; anterior coxæ distinct, very small, cavities open behind; middle and posterior coxæ widely separated, the latter transverse; legs strongly retractile; tarsi slightly pubescent beneath.

The members of this family in general form and structure are very like *Lissomus* (THROSCIDÆ), and in the Munich Catalogue they are placed between the TRIXAGIDÆ (THROSCIDÆ) and EUCNEMIDÆ; they also bear a superficial resemblance to certain EROTYLIDÆ. They are upwards of 100 in number, and include two genera, *Monomma* and *Hyporrhagus*; the latter belongs to the New World, and the former is chiefly confined to Madagascar; one species, *M. brunneum*, Thoms., has been recorded from India.

This appears to be one of the doubtful groups which might be excluded from the HETEROMERA as exceptional, like *Acritus*, *Anisotoma*, etc.; at present there is no consistent rule in the matter.

[Family 77. NILIONIDÆ.]

Hemispherical insects, resembling Coccinellidæ; *head vertical, resting in repose against the anterior coxæ; eyes transverse; antennæ eleven-jointed, inserted in front of the eyes; prothorax foliaceous at the sides; anterior and intermediate coxæ moderately, posterior strongly, transverse, anterior coxal cavities apparently open behind*; tarsi filiform; claws simple; abdomen with five visible ventral segments; epimera of the mesosternum very large.*

These insects have been classed with the Tenebrionidæ, from which they are separated by having the anterior coxal cavities apparently open behind, and the reflexed portion of the elytra very broad; they have been raised to the dignity of a separate family simply because it has been found impossible to class them with any other, although it seems doubtful whether this will stand eventually. It has been proposed to remove them to the Clavicorns, in spite of their heteromerous tarsi. The family contains about twenty or thirty species from Central and Tropical America; they are found walking slowly on fungi or on the trunks of trees near fungi, and when alarmed feign death, but do not fall. Lacordaire, who has recorded these facts (v, p. 519), says that they exhale strongly the peculiar smell of the boletophagous Heteromera.

[Family 78. PETRIIDÆ.]

Form slender, elongate; antennæ inserted before the eyes, eleven-jointed, long and filiform; head very slightly narrowed behind the eyes, but not pedunculate; eyes subreniform; prothorax subcylindrical, narrower than the elytra; anterior coxal cavities almost closed behind, anterior coxæ subconical, not transverse, prominent and nearly contiguous, intermediate pair contiguous, posterior pair slightly separated, strongly transverse; elytra not reaching the apex of the abdomen, more or less strongly dehiscent; wings ample, exserted; abdomen with five free segments, mobile; legs long and slender, tarsi slender, elongate, neither squamose nor ciliate beneath; claws slender and simple.

The members of this family are weak and loosely fitting insects, and appear to resemble certain Cerambycidæ. They are allied to the Cistelidæ and Œdemeridæ; from the former they differ in general shape and in the formation of the anterior coxal cavities etc., and from the latter in the insertion of the antennæ, the shape of the coxal cavities, and in having all the joints of the tarsi simple. They are few in number and are found in the Trans-Caspian region. Nothing appears to be known at present about their life-history

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* According to Sharp (*l. c.* ii, p. 265) these cavities are really closed, although they have the appearance of being open in consequence of the tips of the epimera being free. Lacordaire (Gen. Coléopt. v, p. 818) says: "leurs cavités cotyloides ouvertes en arrière."

Family 79. ŒDEMERIDÆ.

Elongate, slender insects, often with a delicate integument; head inclined, somewhat narrowed behind, and inserted in the prothorax by a broad neck; antennæ long, or very long, nearly always slender and filiform, sometimes serrate; prothorax narrower at base than the elytra; anterior coxæ large, conical, and contiguous, cavities widely open behind and confluent, posterior coxæ transverse; elytra covering, or almost covering the abdomen; abdomen with five free ventral segments, a sixth sometimes visible in the males; penultimate joints of tarsi dilated or bilobed, claws simple.

This family has been placed by some authors near the MELOÏDÆ, but it is more nearly related to the MELANDRYIDÆ and PYTHIDÆ. Superficially many of the species resemble CANTHARIDÆ, while others are like certain genera of Longicorns; in fact the old writers, especially Linné and Fabricius, regarded several of these insects as belonging to the latter group, and placed them under *Cerambyx*, *Necydalis*, and *Leptura* (*v.* Lacordaire, Gen. Col. v, p. 697). Upwards of 500 species are known, which are very widely distributed. They are usually found on flowers or plants, but Leconte and Horn mention the fact that some species of *Asclera* are found on the ground near water; they occur in both temperate and hot climates, but hardly any have been recorded as yet from the Indian region.

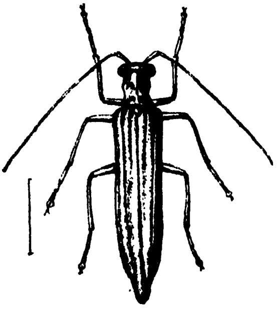

Fig. 72—*Œdemera*, sp. nov. (In British Museum.)

The larvæ are very peculiar, being in many cases furnished with tubercles or pseudopodia on both the dorsal and ventral aspects of the thoracic and anterior abdominal segments; the upper as well as the lower prolegs act as aids to locomotion in the burrows in dead wood in which they live; they are very conspicuous in *Nacerdes* and *Asclera*, but are wanting in *Œdemera virescens*, which is of simpler construction.

The common European *Cantharis*-like *Nacerdes melanura* in remarkable for inhabiting the sea-shore, where its larva lives is timber cast up by the sea or in piles driven into the sand.

[Family 80. PYTHIDÆ.]

Head not constricted behind, sometimes produced into a rostrum; antennæ eleven-jointed, inserted under small oblique frontal ridges; prothorax narrowed at base; anterior coxæ conical, usually contiguous, middle coxæ rounded, posterior coxæ transverse, anterior coxal cavities open behind; elytra covering abdomen; tarsi slender, claws simple.

The only characters that separate this family from the MELANDRYIDÆ appear to be the narrowing of the pronotum at the base, and the fact that several of the species have the front produced, and in some cases forming a distinct rostrum. Only about 100 species are known, and these are mostly confined to temperate and cold climates, although some are found in Madagascar, Chili, etc. The type genus *Pytho* is very depressed, and the larva is long, parallel-sided, and glabrous, with a large semicircular head and a deep furrow running down the rest of the segments until the last, which is slightly narrowed and furnished with two widely separated, strong, and slightly incurved appendages; it is found under bark of fir and pine. Several of the other genera are attached to the same trees, while more are found on umbelliferous and other flowers; others (e. g. *Comonotus*) under stones. The larvæ of *Rhinosimus* and *Lissodema* are remarkable for the triply emarginate apical segment, that of *Rhinosimus* being deeply, almost circularly, emarginate in the centre and divided into two cleft lobes shaped like fish-tails (*v.* Perris, Larves de Coléoptères, pl. ix, figs. 319, 326, 328).

[Family 81. MELANDRYIDÆ.]

Head usually deflexed, not constricted behind the eyes; antennæ eleven-jointed, rarely ten-jointed, as a rule filiform, inserted under very small oblique frontal ridges; anterior coxæ variable, separated or contiguous, cavities open behind; posterior coxæ transverse, more or less contiguous; prothorax broad behind; legs slender, claws simple; abdomen with five ventral segments.

The constitution of this family has hardly been settled, as some authors include under it genera which are excluded by others. Leconte and Horn, for instance, regard *Scraptia* and *Mycterus* as belonging to it, while *Osphya* (*Nothus*), now regarded as a Melandryid, used formerly to be placed in the ŒDEMERIDÆ. The family contains about 200 species, which occur in fungi and rotten wood or under bark; *Osphya* alone is found on flowers, and varies greatly in the sexes. The larvæ are variable. The species appear to be confined to the cold and temperate regions of the northern hemisphere, and very few are found in hot climates.

Family 82. SCRAPTIIDÆ.

Small and very delicate insects; head more raised than the anterior margin of the prothorax, strongly constricted behind the eyes; upper surface depressed; antennæ filiform; eyes deeply emarginate; maxillary palpi more or less strongly securiform or elongate securiform; anterior coxal cavities open behind; posterior tibiæ as long as the tarsi; penultimate joint of tarsi strongly bilobed; claws toothed at base, the teeth being rudimentary.

This family comes between the MELANDRYIDÆ and MORDELLIDÆ and is here regarded as containing *Scraptia* (under which *Allopoda*, Lec., *Calasia*, Hald., and *Canifa*, Lec., are included), *Pseudoscraptia* and *Trotomma*. The species, some thirty or forty in number, are mostly confined to the Palæarctic region, but one species of *Scraptia* has been described from Ceylon and two or three from Chili. As a rule they are very scarce, but are occasionally found in numbers. The species of *Scraptia* occur in rotten wood, hard fungus on trees, etc. They bear a strong resemblance to *Anaspis*, and appear to fall most naturally under the MORDELLIDÆ, but in several points they are more closely allied to the MELANDRYIDÆ, and I have already pointed out (Coleoptera of the British Islands, vol. v, p. 64) that it seems the best plan to regard them as a separate family, as it places the insects in a position between the two families without connecting them with either. The genus *Scraptia* has been classed by different authors with very different Heteromerous families.

The larva of *Scraptia fuscula*, Müll., has been described and figured by Perris (Larves de Coléoptères, p. 341, pl. x, f. 371); it is elongate and setose at the sides, and presents no striking peculiarity except as regards the last abdominal segment, which is as long as the three preceding and elongate spoon-shaped. It appears to offer no point of connection with either the larvæ of *Mordella* or *Melandrya*, and differs entirely from the larva of *Anaspis* in the formation of the last abdominal segment Both the larva and the perfect insect are probably, to a certain extent, myrmecophilous.

Family 83. MORDELLIDÆ

Head vertical, ridged behind, when at rest bent under the prosternum, suddenly constricted just behind the eyes, neck very small; antennæ eleven-jointed, slender, inserted before the eyes; maxillary palpi with the last joint more or less securiform; prothorax as wide at base as elytra, with the margins sharp and distinct; anterior coxæ large and conical, cavities open behind; posterior coxæ laminate, sometimes

very large; tibial spurs large; abdomen with the apex uncovered, in the first group produced into a strong style, visible segments five or six, abdominal surface convex or subcarinate.

We have regarded the RHIPIPHORIDÆ as distinct, although they might be with reason included under this family. About 400 MORDELLIDÆ are known; they are variable, but easily recognizable and fall into two subfamilies as follows:—

I. Apex of abdomen produced into a strong style	MORDELLINÆ.
II. Apex of abdomen not produced into a style	ANASPINÆ.

The perfect insects are found for the most part on flowers herbage, shrubs, and low branches of trees, but some occur in decaying trunks. The larvæ are in some cases found in rotten wood, while in others they live and feed in the stems of plants; sometimes they are found in the old burrows of wood-boring insects. The larvæ of *Mordellistena* are elongate and curved, and are furnished (at all events in some species) with protuberances on the first five or six abdominal segments; these are also present in the pupæ; the anal segment is variable, and in *Anaspis* is cleft into two processes. A few are believed to be carnivorous, but this does not appear as yet to have been decisively proved.

The ANASPINÆ have been regarded as peculiar to northern temperate climates, while the MORDELLINÆ have been recorded chiefly from Europe and North America; but Mr. Guy Marshall informs me that he has eight species of the former and sixteen of the latter from South Africa. *Mordella* and *Mordellistena* are represented in Ceylon, if the records of Walker and Motschulsky are correct.

Family 84. RHIPIPHORIDÆ.

Head vertical, resting against the anterior coxæ; antennæ eleven- or ten-jointed, variable and varying in the sexes; prothorax as broad at base as elytra, with the sides not forming a sharp edge; anterior coxæ large, conical, contiguous, cavities widely open behind and confluent; posterior coxæ transverse, more or less contiguous; elytra sometimes covering the abdomen, often dehiscent, and rarely wanting (in the larviform female of Rhipidius*); metasternum large; abdomen with free segments, varying in number; claws variable, pectinate, toothed or (rarely) simple.*

There are no clear characters at present defined for the separation of this family from the MORDELLIDÆ, and, as *Evaniocera* and its allies form a transitional group between the two, it might perhaps be better to follow Dr. Sharp in regarding them as merely subfamilies of one family; at the same time, as he himself hints, it is possible that a study of the head may cause the separation of the group into several families, so that it can hardly be wrong to treat them as distinct. The insects belonging to the parasitic sections have exceedingly interesting life-histories, which are as yet only partially known. The most familiar is *Metœcus paradoxus*, which is parasitic on wasps. The greater part of its history has been worked out by Dr. Algernon Chapman (Ann. Mag. N. H. (4) vi, 1870, p. 314, and Ent. Mo. Mag. 1891, p. 18). The young larva appears to be similar to that of the campodeiform larvæ of the MELOÏDÆ; it is a little black hexapod, about ½ mm. in length, broadest about the fourth segment and tapering to a point behind; the tibiæ end in two or three claws (biungulin or triungulin), which support and are obscured by a large transparent pulvillus or sucker of about twice their length; the last segment is terminated by a large double sucker similar to those of the legs. How the young larva enters the wasps' nest is not quite known, but Dr. Chapman has found the eggs in dead wood and thinks it probable that they are carried by the wasps to their nests in the wood shavings which they use for their construction. It seems more probable, however, that the active larvæ hatch out and attach themselves to the wasp while it is gathering this wood*. At any rate the young larva finds its way into a cell containing a wasp larva and immediately attacks it and penetrates into its interior; after feeding within the larva and increasing largely in size it quits the host, changes its skin, and then becomes shorter and thicker. At this stage it is found lying like a collar under the head of the wasp-grub, whose juices it goes on devouring; it then again changes its skin, devours the whole remainder of the grub, changes to a pupa, and a few days afterwards emerges as a perfect insect. The full-grown larva is very

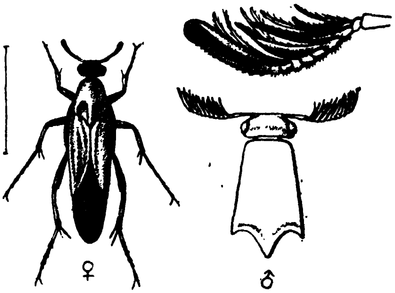

Fig. 73.—*Emenadia ferruginea*; female.
Head and prothorax of male. Antenna of male.

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* A fact against this is that no wasps have been found infested with these larvæ, as are the *Andrenæ* with the young *Meloë* larvæ; at the same time I believe that the larva and not the egg must be carried to the nest. Dr. Chapman takes strong exception to my theory (Brit. Col. v, p. 81) that the egg is laid in the cells.

like a *Crabro* or *Pemphredon* larva, and its appearance apparently deceives the wasps themselves, for they are, it is thought, hostile to the perfect insect *.

Symbius blattarum is a very remarkable insect and is parasitic on cockroaches (BLATTIDÆ). The male is winged, but the female is larviform and apterous, and never leaves the body of the cockroach; its life-history is not fully known.

The family contains more than 100 species, the greater number of which inhabit temperate climates; four or five species of *Emenadia* occur in the Indian region.

Family 85. MELOÏDÆ (including LYTTIDÆ).

Head vertical, strongly and suddenly constricted at some distance behind the eyes, with an abrupt neck; antennæ variable, usually eleven-jointed, inserted before the eyes at the sides of the front; prothorax nearly always narrower at the base than the elytra †, *not margined; anterior and middle coxæ large, conical, and contiguous; anterior coxal cavities large, confluent, open behind; posterior coxæ transverse, prominent, nearly contiguous; elytra variable; abdomen with six free ventral segments; each claw with a long appendage closely applied beneath it, or toothed; integument more or less soft.*

This well known family is in part remarkable for the very curious hypermetamorphosis in their life-history, and the various forms of larva and pupa, beginning with the active triungulin which infests bees and by them is carried to their nests; and in part for the fact that many of its members contain the substance

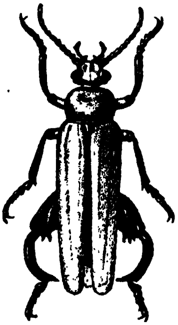

Fig. 74.—*Horia debyi* (natural size).

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* Some authors, however, believe that it secretes a fluid agreeable to the wasps amongst which it is found (Ent. Nachr. xi, p. 34); this, however, seems doubtful: if it be true, then it seems quite possible that the perfect insect may obtain the opportunity of ovipositing within the nest.

† In *Cephaloon* it is only as broad at the base as the elytra.

"cantharidine," which is of so much use in medicine for producing blisters; the property has apparently been known from very early times. The life-histories of *Sitaris* and *Epicauta* have been referred to above (pp. 32, 33).

The family falls into two well-marked divisions as follows:—

I. Side-pieces of the meso- and meta-sternum covered by the elytra, the inflexed portion of which is very broad; elytra abbreviated and imbricate; metasternum short .... MELOÏNÆ.

II. Side-pieces of the meso- and meta-sternum not covered by the elytra, the inflexed portion of which is narrow; metasternum long .... LYTTINÆ.

The species of *Meloë* are wingless and are found on the ground, the LYTTINÆ for the most part are active and occur on trees and flowers, etc.; *Sitaris* is found on or about old walls (its transformations are figured on p. 32).

The family contains about 1500 species, which are very widely distributed; several species of *Mylabris* and *Lytta* occur in India, but on the whole the group is very poorly represented both in the Indian and Australian regions.

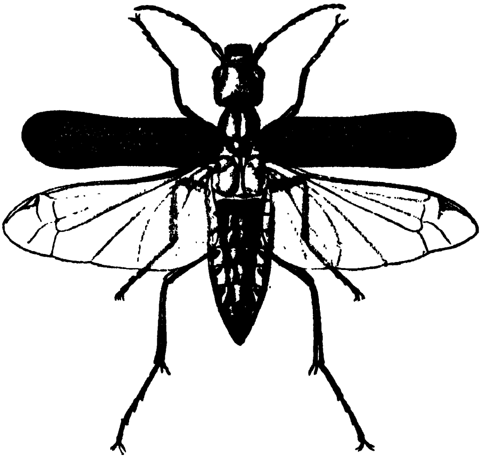

Fig. 75.—*Epicauta actæon* (natural size).

Leconte and Horn form a separate family CEPHALOIDÆ for the reception of the few species of the rare genus *Cephaloon*, which has the base of the prothorax as broad as the base of the elytra. It is, however, best left at present under the MELOÏDÆ; only a very few species have been described (from Siberia, Japan, and North America), and very little is known about them.

Family 86. PYROCHROIDÆ.

Head exserted, strongly constricted behind the eyes, which are emarginate; antennæ eleven-jointed, inserted before the eyes; prothorax narrower at base than elytra; anterior coxæ large, conical and contiguous, cavities widely open behind; intermediate coxæ conical, contiguous, posterior coxæ transverse; elytra ample, wider than abdomen; abdomen with five free ventral segments, a sixth being visible in the male; legs long, penultimate joints of tarsi bilobed or dilated, claws simple.

This family is allied to the MELANDRYIDÆ, but differs in the formation of the head and neck, and the bilobed or dilated penultimate joints of the tarsi; it includes some forty to fifty species which have been found mostly in temperate or cold climates (North Europe, Siberia, Northern Japan, and North America). Several fine and beautiful species, however, have recently been found in Burma by Mr. Doherty, and species have also been recorded from Bengal and Kashmir. They are, in many cases, comparatively large and conspicuous insects, of a brilliant scarlet colour, or scarlet with a black head, or black with a scarlet prothorax, and are sometimes remarkable for their strongly pectinate or ramose antennæ. They are usually found

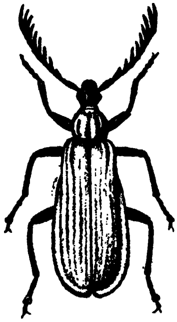

Fig. 76.—*Pyrochroa*, sp. n. (British Museum.—Natural size.)

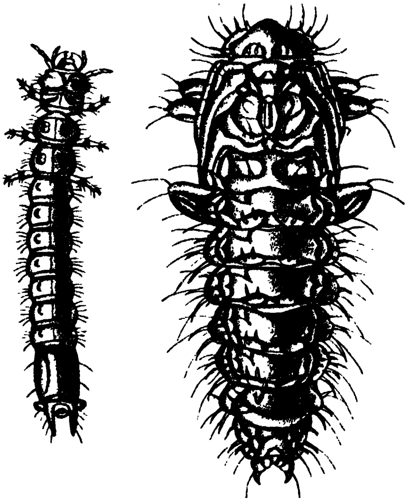

Fig. 77.—*Pyrochroa coccinea*; larva × $\frac{3}{2}$; pupa × 3. (After Schiödte.)

under bark, in stumps, or, in hot weather, on flowers and shrubs.

The larvæ of *Pyrochroa* are elongate, parallel-sided, flat insects, varying a little in the shape of the thoracic segments and the anal appendages; the head is very large and the penultimate segment is very long; the apical segment is strongly turned up (almost at right angles) and terminates in two strong chitinous spines. They occur under bark of various trees or in decaying stumps.

Family 87. XYLOPHILIDÆ.

Closely allied to the Anthicidæ, *and agreeing with that family in most of its characters, but differing in the extremely small and simple penultimate joint of the tarsi, which is concealed between the lobes of the antepenultimate joint, so that the tarsi at first sight appear to be 4-, 4-, 3-jointed; and also in the fact that the first two segments of the abdomen are connate, and that the posterior coxæ are more or less approximate.*

This family contains about 150 or 200 species which are united by several authors with the ANTHICIDÆ. They are very widely distributed in most parts of the world, and will probably prove to be very numerous; only twenty-nine species of *Xylophilus* are enumerated in the Munich Catalogue, but Mr. Champion has described no less than thirty-six from Central America, two-thirds of which are represented by single specimens only; the greater part of them were found in oak-woods at elevations of from 3000 to 8000 feet, and a considerable number were beaten from decaying branches of oak. The European species are found in old trees, dead hedges, and occasionally on flowers; the earlier stages are, apparently, found in rotten wood. The genera *Macratria* and *Xylophilus* are represented by a few species from the Indian region, especially Ceylon. Many of them, at first sight, might be mistaken for small ANOBIIDÆ, while others are like *Anthicus*; from the latter they may be distinguished by the characters given above, and by the more or less emarginate, hairy, and coarsely granulated eyes.

Family 88. ANTHICIDÆ.

Small insects, many of them in general appearance resembling ants; head rather large, deflexed, constricted at some distance behind the eyes, which are elliptical and entire; antennæ eleven-jointed, inserted at the sides of the front; neck very small; prothorax narrower at the base than the elytra, with the sides not margined; anterior coxæ conical, prominent and contiguous, cavities open behind,

confluent; intermediate coxæ almost contiguous, posterior coxæ somewhat distant; abdomen with five free ventral segments, the first being much longer than the second; tarsi with the penultimate joint bilobed; claws simple.

This is rather a large family and contains about 800 species, of which the majority belong to the genus *Anthicus*; they are widely distributed throughout the world from Siberia to the Australian region. They are well represented in India by several genera and a considerable number of species. As a rule they live on the ground in damp places, salt-marshes, the margins of ponds, on sand hills, etc. Some are found in manure heaps and hot-beds, and in summer certain species are often swept off herbage. There is nothing remarkable about them, except their ant-like appearance (*Formicomus*, *Anthicus*, etc.), which seems to be purely accidental. The life-history does not appear to be known. The species of *Notoxus* are remarkable for having the anterior portion of the prothorax prolonged over the head into a long and robust horn; and the small insects forming the genus *Mecynotarsus* are distinguished by their long and slender tarsi.

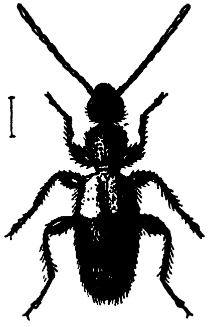

Fig. 78.
Formicomus mutillarius.

Family 89. TRICTENOTOMIDÆ.

Head horizontal, mandibles strong and projecting; antennæ inserted before the eyes, near the base of the mandibles, stout, eleven-jointed, the last three joints serrate internally; eyes moderate, transverse, sinuate in front; prothorax with sharp denticulate margins, narrower than elytra; anterior and posterior coxæ strongly transverse, anterior coxal cavities open behind; tarsi subcylindrical, all the joints, except the last, furnished underneath at apex with a small tuft of hairs; abdomen with five visible ventral segments; episterna of metasternum very broad, parallel-sided; size very large (2½–3 inches).

The position of the large and conspicuous insects which constitute this family has been much disputed. In facies they bear a resemblance to the Longicorn Prioninæ, and have been placed by several authors of repute among the Longicornia; others again have classed them with the Lucanidæ, and others with the Cucujidæ. They are, however, distinctly Heteromera, and are now generally regarded as such. They are only found in the Indian and Indo-Malayan regions, in the forests of the Himalayas, Ceylon, Tenasserim, and Borneo. The larva has recently been discovered* and has been described and figured by Mr. C. G. Gahan (Trans. Ent. Soc. Lond. 1908, p. 275, pl. vi, fig. 1). It is nearly 4¾ inches long, parallel-sided, but uneven in outline, as the segments are narrowed in front and behind; the head is large

Fig. 79.

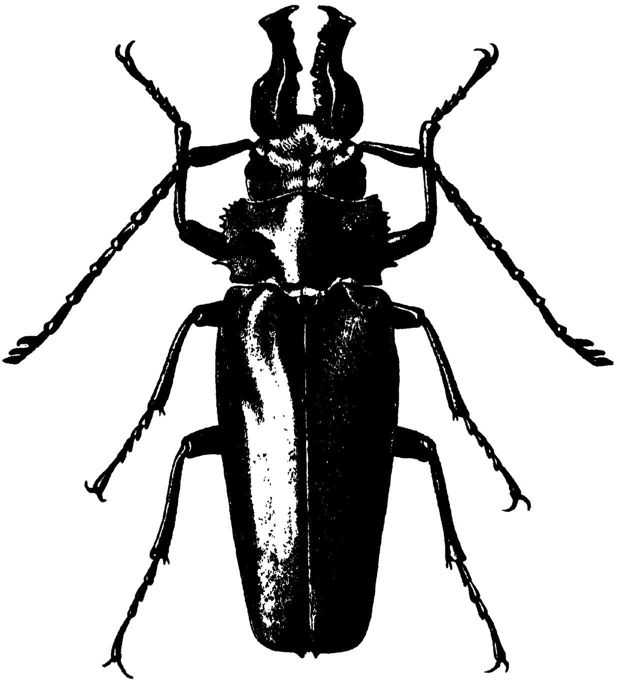

Fig. 80.

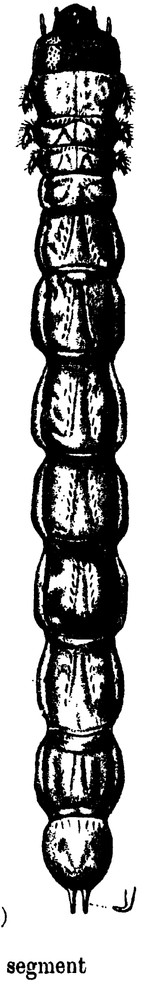

Fig. 79.—*Autocrates æneus* (natural size).
Fig. 80.—*Trictenotoma childreni*; larva. (Natural size; after Gahan.)

and the first abdominal segment is short; the last segment is narrower than the preceding and terminates in two short, bent processes; the legs are distinct, but not long. The general appearance is that of a very large *Pyrochroa* larva, and this family ought perhaps to be placed near the PYROCHROIDÆ.

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* The perfect insect has not been bred from the larva, but it is practically certain that the latter must be referred to the TRICTENOTOMIDÆ.

Division 5. PHYTOPHAGA.

There has been considerable doubt as regards the constitution of this group, which is here regarded as including the LARIIDÆ (BRUCHIDÆ), CERAMBYCIDÆ and LAMIIDÆ (LONGICORNIA), and CHRYSOMELIDÆ. These families vary much in size, shape, and coloration, but are all plant-feeders, as the name implies. The members of the group, as at present known, are very numerous and must amount to nearly 40,000; this, however, probably represents only a fraction of the species at present existing on the globe.

The following are the chief characteristics of the united group, as here defined; it is possible that the RHYNCHOPHORA ought to be included, but we have followed most authors in treating them as separate, for convenience' sake, rather than because they are manifestly distinct:—Antennæ usually simple, filiform or moniliform, rarely serrate or irregular; gular suture distinct; pronotum with distinct margins; wings of the Cantharid type (Type III. pp. 41, 42), the characteristic venation, however, being variable and sometimes more or less breaking down; tarsi 5-jointed, but apparently 4-jointed, the fourth joint being very small and inserted into and received by the third joint (which is deeply bilobed) at its base*, the first three joints usually thickly pubescent beneath. The follicles of the testes are said to be roundish and stalked, but the characters drawn from the testes appear to be untrustworthy, as they have recently been found to be quite different in *Timarcha* from those of the allied genera. Six Malpighian tubes are present. The larvæ are eruciform (never campodeiform) with the legs moderate, short, very short, rudimentary or absent. The nervous system in the CHRYSOMELIDÆ and CERAMBYCIDÆ is variable, but appears to consist of three thoracic ganglia and four or five abdominal ganglia; in *Clythra*, *Chrysomela*, and *Adimonia* it seems to be more concentrated, and in the LARIIDÆ (BRUCHIDÆ) it is still more concentrated and approaches the structure of the nervous system of the RHYNCHOPHORA, thus forming further proof that the last-mentioned family forms a transition between the two great groups.

The LARIIDÆ (BRUCHIDÆ) are distinguished from the other members of the Phytophaga by having the mentum supported on a peduncle and the head shortly and flatly produced; it is, however, impossible to separate the CHRYSOMELIDÆ and CERAMBYCIDÆ on any definite characters; the eyes are usually entire in the former family and more or less surround the antennæ in the latter, and the CHRYSOMELIDÆ are, as a rule, bare and shining, while the CERAMBYCIDÆ are pubescent and dull, but many exceptions occur, and certain genera of the former might easily be mistaken for the latter. This is particularly noticeable, for instance, in the pubescent genus *Temnaspis*, Lac., of which eight species occur in India; these bear a striking resemblance to small members of the Longicorn group, and are very hard to distinguish from them, except after careful examination.

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* Almost the only, if not the only, exception, appears to be the genus *Hæmonia*.

The four families here included under this group may be roughly distinguished as follows:—

I. Mentum pedunculate	**Lariidæ (Bruchidæ),** [p. 177.
II. Mentum not pedunculate.	
i. Antennæ short or moderate, not inserted on frontal prominences; tibial spurs usually absent	**Chrysomelidæ,** p. 178.
ii. Antennæ usually long or very long, frequently inserted on frontal prominences; tibial spurs distinct.	
1. Head in front oblique or subvertical..	**Cerambycidæ,** p. 185.
2. Head in front vertical or bent inwards below the thorax	**Lamiidæ,** p. 188.

Family 90. LARIIDÆ (BRUCHIDÆ).

Head free, produced in front, mentum pedunculate; antennæ eleven-jointed, often serrate or pectinate, inserted at the sides of the head in front of and near the eyes; prothorax margined at the sides; anterior coxæ oval, the cavities closed behind; intermediate coxæ oval; posterior coxæ transverse, almost contiguous or only narrowly separated; abdomen with five free ventral segments; elytra truncate, pygidium exposed; posterior femora more or less thickened, tarsi with the first joint elongate, and the claws broadly toothed at the base.

In the Munich Catalogue (1873) four hundred and twelve species are enumerated as belonging to this family, and about seven hundred are now known; a fair number are found in India and Ceylon. Several of the species are cosmopolitan, as, from their habit of feeding in the larval state on the seeds of leguminous plants, they are largely carried from one country to another in cargoes of peas, beans, etc. They are exceedingly destructive to these, and in tropical climates do great damage to the seeds of *Gleditzia*, *Mimosa*, *Acacia*, *Theobroma*, etc., while some species attack cocoa-nuts and palm-nuts. The larvæ, so far as known, are fat and broad small maggots, some of which, at any rate, are provided with very short legs in their earlier stages, but lose them in the later. There is probably (to judge from the species already known)

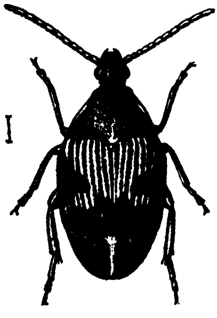

Fig. 81.—*Laria (Bruchus) scutellaris.*

considerable difference in their habits. It has been thought that they lay their eggs on the actual peas, beans, etc., while yet soft, but Riley, who has worked out the life-history of *Laria pisi*, the "pea-beetle," has ascertained that the young larva of this species mines the pea-pod before it enters one of the peas. Apparently (as proved by Mr. Theodore Wood) the larva has the instinct, or whatever we may call it, to leave the germ untouched, so that the plants sprout; they are, however, more or less sickly and are almost barren after these attacks.

The position of the family has long been a subject of discussion and many authors have assigned it to the RHYNCHOPHORA, in close proximity to the ANTHRIBIDÆ. There can, however, be no doubt that its affinities are rather towards the CHRYSOMELIDÆ, from which it cannot be separated. A transition towards the RHYNCHOPHORA is found in the URODONTIDÆ, which have been included under the LARIIDÆ, but evidently belong to the Rhynchophorous group, and come close to the ANTHRIBIDÆ.*

As a matter of fact the LARIIDÆ are not very closely allied to any other group, but appear to be most nearly related to the SAGRINÆ; they are, therefore, best placed at the beginning of the PHYTOPHAGA immediately before *Sagra* (*v.* Fowler, Col. of British Islands, iv, p. 258).

This family is called MYLABRIDÆ by some authors, and the name BRUCHIDÆ has been substituted for PTINIDÆ, and *Zonabris* for the well-known *Mylabris*, thus causing considerable confusion, so that it is best (with Ganglbauer and others) to adopt the name LARIIDÆ for the group, and avoid the term BRUCHIDÆ altogether.

Family 91. CHRYSOMELIDÆ.

Form variable; head prominent or inserted in the prothorax as far as the eyes; antennæ as a rule not at all surrounded by the eyes, variable in length, shape and position of insertion, usually eleven-jointed, filiform, moniliform, serrate or slightly clavate; coxæ variable in shape and position, prothorax with or without lateral margins; elytra nearly always covering abdomen, but occasionally leaving the pygidium exposed; abdomen with five segments of varying length; legs very variable, posterior femora very strongly thickened in some groups, and often dentate beneath; tarsi, as before described, pseudotetramerous.

This is one of the largest families of the Coleoptera, and contains about 20,000 known species; it is very largely represented in India, and the late Mr. Jacoby had, before his death, completed one volume of the Fauna of British India containing the first portion of the family, and hoped to complete it in three volumes; in the part already published he has dealt with 903 species, so that the number with which he was acquainted must be about 2700 to 3000, and this probably represents only a comparatively small proportion of the whole number of species existing in the region.

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* Lameere (Ann. Soc. Ent. Belg. xliv (ix), 1900, p. 377) separates the ANTHRIBIDÆ from the RHYNCHOPHORA and regards them as a subfamily of the BRUCHIDÆ, which with the CERAMBYCIDÆ, CHRYSOMELIDÆ, and CURCULIONIDÆ are classed by him under the PHYTOPHAGA.

We have before alluded to the difficulty of distinguishing between the CHRYSOMELIDÆ and the CERAMBYCIDÆ in several groups. Mr. Jacoby states that it may be taken as a general rule that in the LONGICORNIA "the shape is very elongate, the head projecting and prominent, the eyes oblique and more or less divided and the antennæ peduncular, these organs being at the same time rigid and tapering at the apex. All these structures are not as a rule found in the CHRYSOMELIDÆ."

The following is a key to the divisions adopted by Mr. Jacoby in his work (*l. c.* p. 3):—

I. Mouth placed anteriorly.
  i. Antennæ widely separated at base; elytra of hard texture.
    1. Intermediate ventral segments not medially constricted; pygidium not exposed.
      A. Thorax without distinct lateral margins, head produced, eyes prominent, prosternum exceedingly narrow .... EUPODES.
      B. Thorax with distinct lateral margins (rarely without), head not produced, eyes not prominent, prosternum broad .... CYCLICA.
    2. Intermediate ventral segments constricted; pygidium usually exposed .... CAMPTOSOMES.
  ii. Antennæ not widely separated at base, generally closely approximate; elytra more or less soft in texture .... TRICHOSTOMES.
II. Mouth not normal, small, hidden or nearly so .... CRYPTOSTOMES.

1. EUPODES.—This group contains the SAGRINÆ, CRIOCERINÆ, and DONACIINÆ, which are all represented in India. The SAGRINÆ are large and brilliant insects with the posterior femora very strongly thickened; very little is known of their habits. *Donacia* is more characteristic of temperate climates and only four species have been recorded from the Indian region; it is chiefly remarkable for the peculiar habits of the larvæ, which live under water and apparently suck air from the aquatic plants by means of two spines at the apex of the body, which are believed to have a stigma at the base of each, although this seems hardly proved. The CRIOCERINÆ are chiefly represented in the Indian fauna by the genus *Lema*, of which no less than 118 have been found in the region. The larva of *Crioceris* has the power of covering itself entirely with its excrement, but it has no special process for supporting this; the covering does not adhere closely to the body of the larva and can, indeed, be thrown

off at will. The object of this provision in certain of the PHYTOPHAGA is not quite clear, but it is possible that it may serve as a means of protection and defence. According to Sharp and other authors many of the CRIOCERINÆ have the power of stridulating, the organ being situated at the base of the last dorsal abdominal segment, and consisting of five raised lines which are rubbed by the apex of the elytra.

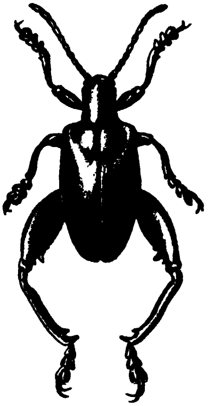

Fig. 82.—*Sagra femorata* (natural size).

2. CYCLICA.—These include the mass of the CHRYSOMELIDÆ (*Lamprosoma*, *Eumolpus*, *Chrysomela*, *Nodostoma*, etc.). Occasionally the larvæ are injurious to vegetation. The well known Colorado potato-beetle (*Leptinotarsa decem-lineata*) belongs to this group, as also does the mustard-beetle (*Phædon*), etc. The species of this and the succeeding group are in many cases the most permanently brilliant of the whole family, but are surpassed by many of the CRYPTOSTOMES, while the latter are living or in quite a fresh state.

3. CAMPTOSOMES.—This group includes the well-known genera *Cryptocephalus*, *Clytra*, *Chlamys*, and *Gynandrophthalma*, the remarkable Longicorn-like genus *Temnaspis*, before referred to, and several others of considerable interest. The larvæ of a number of the species live in portable cases; those of *Cryptocephalus* (Weise, Naturg. Ins. Deutsch. vi, p. 139) remain, with the abdomen curved against the breast, in a cylindrical bag, which is narrowed in front and from which they can only emerge as far as the first abdominal segment; this case is carried in an oblique, almost upright, position, the larva progressing with a jerky motion. The pupæ are attached to dry leaves and stems of grass.

4. **Trichostomes.**—In these are included the **Galerucinæ** and **Halticinæ**, which differ extremely in form, but have several characters in common. The latter family have strong leaping powers, owing to their thickened femora, and are therefore very active, while the **Galerucinæ** are softer and feebler, with slender and weak legs. Some of the quite minute **Halticinæ** are very destructive to certain kinds of vegetation. This new group does not seem to have a very definite value.

5. **Cryptostomes.**—This group consists of the **Hispinæ** and **Cassidinæ**, both of which are in many cases very remarkable for their general appearance. The species of *Hispa* are for the most part covered with long, upright, coarse spines; while the **Cassidinæ**, or tortoise-beetles, although variable in shape, are all provided with more or less pronounced expanded margins, beneath which the body and head are completely hidden; their outline varies in shape, but they are usually more or less circular or shield-shaped, and often hemispherical or sub-hemispherical. Many of the species are remarkable for their brilliant metallic colours in life, which unfortunately fade very quickly after death; some of the Indian species are very beautiful, and if kept in glycerine or spirits of wine will retain their colour for a considerable period.

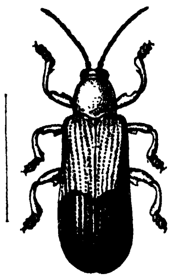

Fig. 83.—*Botryonopa sheppardi.*

The life-history of *Hispa testacea* is given fully by Chapuis (Genera des Coléoptères, xi, p. 259), and is quoted by Sharp (Cambridge Natural History, vi, p. 283). The larva mines the leaves of *Cistus salvifolius* in Southern Europe and feeds on the parenchyma of the leaf, which it only ruptures when it wants to remove to a fresh leaf; it is a broad and flat insect with short legs.

The larvæ of the **Cassidinæ** are remarkable for their habit of covering themselves with a coating of excrement, which, however, is not free as in the **Criocerinæ**, but is, in nearly all cases, supported by a forked appendage arising from the apex of the

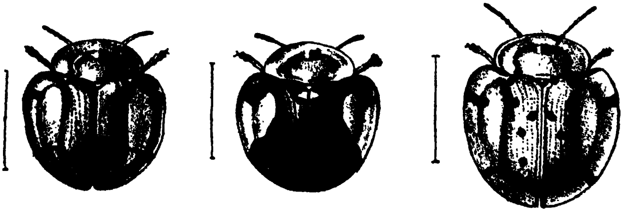

Fig. 84.—*Cassida miliaris* (varieties).

abdomen. This appendage appears to be wanting in the larvæ of *Porphyraspis palmarum*, which forms a sort of bird's-nest-like enclosure from long threads of excrement; these are attached at their base to the surface of the last abdominal segment, as described by Candèze (Mém. Soc. Roy. Sc. Liège, 1861, p. 387, pl. xvi), and figured by Sharp (*l. c.* p. 284).

The larvæ and the life-histories of the members of the family are, as might be expected, very different; the following table of the larvæ is for the most part that given by Chapuis (Gen. Coléopt. x, p. 15) with alterations by Sharp (Cambr. Nat. Hist. vi, p. 279):—

I. Larvæ with the body uncovered.
  1. Larvæ elongate, subcylindrical, whitish, living on, or in the stems of aquatic plants, under water; pupæ also subaquatic, contained in cocoons fixed to the root of the plants. DONACIINÆ.
  2. Larvæ mining, more or less elongate, sublinear or narrowed at each end, undergoing their metamorphoses in the leaves in which they live. HISPINÆ and some HALTICINÆ.
  3. Larvæ short, oval, very convex above, often more or less brightly coloured, or dark metallic, living exposed on plants and undergoing their metamorphoses on the plants or in the ground. Most of the CYCLICA.

II. Larvæ with the body protected by excrement.
  1. Larvæ short, oval, very convex above, dark coloured, without any special apparatus for carrying the excrementitious matter, undergoing their metamorphoses in the ground. CRIOCERINÆ (in part).
  2. Larvæ short, oval, somewhat depressed, spiny, with the excrementitious matter supported and attached by a special apparatus, undergoing their metamorphoses on leaves. CASSIDINÆ.

III. Larvæ elongate and whitish, with the abdomen curved, inhabiting portable tubes or cases and undergoing their metamorphoses in these.
CLYTRINÆ, CRYPTOCEPHALINÆ, CHLAMYDINÆ, etc.
(in fact, most of the CAMPTOSOMES known).

The next two families form the important group which is ordinarily known by the name of LONGICORNIA. This group is so well known and has been so well worked that the name is sure to be retained whatever classification may be adopted. The species are usually elongate and parallel-sided or not much rounded at the sides, and, as a rule, possess, as their name implies, long, or very long, antennæ; in some genera, however, the antennæ are quite short, and in others the form is more convex and rounded. They are very closely connected with the CHRYSOMELIDÆ, and although individually they are not at all likely to be confused with the latter, yet the differences are hard to express in words. Dr. Horn (Class. Coleopt. N. Amer. p. 269) says that "so far the essential difference between the TETRAMERA, of which the larvæ feed upon wood, and those feeding upon vegetable cellular tissues, has eluded observation. We can merely, at present, observe that a slight approximation to it seems to be made in the fact that in the CERAMBYCIDÆ (here regarded as including all the LONGICORNIA) there is a tendency in the epimera of the metathorax to extend to the sides of the ventral segments, while in the CHRYSOMELIDÆ the first ventral segment is prolonged forwards at the sides to meet the metathorax, thus showing probably a lower, though necessarily more recent type, which could have existed only since the development of the higher broad-leaved plants."

According to Lameere (Ann. Soc. Ent. Belg. xliv, 1900, p. 368) the connection between the CHRYSOMELIDÆ and CERAMBYCIDÆ is not a close one. They have probably been evolved from different ancestors, these being, most likely, primitive CLAVICORNIA; he therefore only provisionally adopts the series PHYTOPHAGA, as he is of opinion that the LONGICORNIA in the future will have to be considered as a group distinct from the series altogether. It is possible that he may be right when he regards *Parandra* as the archaic type of the Longicorns, but we cannot agree with him when he says that the study of the genus "shows that the CERAMBYCIDÆ are only a special form of Clavicorns allied to the TROGOSITIDÆ and CUCUJIDÆ."

So far as is at present known, the LONGICORNIA comprise about 12,000 or 13,000 species; although those which have been described are, perhaps, more numerous relatively than in any other section of the order, owing to their striking appearance and coloration, yet it is probable that only a half or a third of the existing species have been discovered. The larvæ differ considerably from one another; as a rule they are elongate fleshy grubs with nothing remarkable about them, but occasionally the prothorax is much widened, so as to suggest BUPRESTIDÆ rather than LONGICORNIA. It is probable that the group may, in the future, be divided on the characters of the legs or absence of the legs; in many cases short legs are present, but in the majority they are absent, and a good many instances occur in which the body has on its surface swellings above and beneath, which are probably intended to assist locomotion in the galleries in wood in which they live; these galleries are sometimes occupied by the same larvæ for several years.

The LONGICORNIA are well known for their cryptic coloration (protective resemblance to various objects), in fact, some of the best instances are found among the members of this group; *Desmophora*, *Batocera*, *Saperda*, and *Lamia* are good instances, but the Indian *Xylorrhiza adusta*, Wied., is still more striking, and the best instance of all is afforded by the large African *Petrognatha gigas*, F. The upper surface of this fine insect is like dead velvety moss, and the antennæ are uneven and exactly like dry wood tendrils. I have before this (Proc. Ent. Soc. Lond. 1901, p. xlv) pointed out the probability that some of the more conspicuous genera of LONGICORNIA are really protected by their striped black and white colouring, which tones down and mingles at a little distance like that of the zebra in the dusk. Among the Longicorns there are many instances of this colouring; the black and white stripes may be arranged longitudinally as in *Ornithia*, *Platyarthron*, *Tæniotes*, and many species of *Dorcadion*, or transversely, or in more or less confluent rows as in *Tmesisternus*, *Colobothea*, etc. Among the Longicorns, also, we find very many instances of true mimicry; to quote what I have said before (*l. c.* p. li): "A great many Coleoptera are protected by their resemblance to well-protected insects, such as ants, bees and wasps, and, in such cases, they often resemble the species they copy, not only in colour but in habit; thus *Clytus arietis* is very different from the usually sluggish Longicorns, and runs swiftly up and down the leaves on which it settles just like a wasp; *Pachyta cerambyciformis*, again, may be seen hovering up and down over shrubs just like Hymenopterous insects. A strong resemblance to wasps and bees is found in members of the Longicorn genera, *Esthesis* (Australia), *Acyphoderes* (Brazil and Mexico), *Sphecomorpha* (Brazil), *Isthmiade* (Brazil), *Hephæstion* (Chili), *Bromiades* (Cuba), and many others; two of the most striking examples are, perhaps, *Callisphyris macropus*, Newm., from Chili and Peru, and *Ulochætes leoninus*, Lec., from British Columbia; the latter is exactly like a species of humble bee." The Longicorn genus *Macrones* (Australia) resembles large BRACONIDÆ, while Dr. Sharp's strange Hawaiian genera *Plagithmysus* and *Callithmysus* have a strongly Orthopterous appearance: *Pseudocephalus* bears a striking resemblance to ants and *Ecthistatus* is like an Arachnid.

The HETEROMERA, as is well known, imitate a very large number of other Coleoptera, but if we study the LONGICORNIA, we shall find that they quite equal them, if they do not surpass them, in this respect. Thus we have *Collyrodes* imitating *Collyris*, and *Gnoma* mimicking *Tricondyla*, among the CICINDELIDÆ; *Buprestomorpha*, as its name implies, is very like a Buprestid; while *Tragocerus* resembles certain ELATERIDÆ. Several species of *Dadoychus* (*Hemilophus*) closely resemble certain LAMPYRINÆ, even to the phosphorescent segments of the underside; in fact, *D. flavocinctus* was described by Chevrolat as a Lampyrid. A considerable number of Longicorns are like HISPINÆ (e.g. *Erythroplatys* and *Æchmutes*), while others resemble LYCINÆ (*Eroschema*, *Pyresthes*, etc.), and others again (e. g. *Oxycalymma telephorina*, Bates) bear a close similarity to CANTHARINÆ; *Acmæops* and *Gaurotes* in several cases are exactly like species of *Crioceris* and *Lema*; *Stephanops* is something like a Brenthid, but a better imitation of small BRENTHIDÆ is found in *Spalacopsis*; *Moneilema* resembles *Blaps*, *Lychrosis* (from India) is like a *Cleonus* (CURCULIONIDÆ), and *Compsosoma* (*Euspherium*) *purpureum*, Newm., might pass as an Erotylid; and so we might go on.

Many of the species have the power of stridulating, the organs being situated on different parts of the body; in some cases the sound is produced by the friction of the inner side of the hinder margin of the prothorax against a striate surface on a short neck in front of the scutellum over which the prothorax fits when at rest (*vide* pp. 187, 188); in others again the sound is produced by rubbing the hind femora against the edge of the elytra; while in others both these organs are present in the same insect.

The peculiar scent given off by some of the species is very worthy of notice; sometimes it is agreeable (as in *Callichroma* and *Aromia*), in others disagreeable (as in *Agapanthia*). At the same time it must be remembered that we cannot tell what is agreeable or disagreeable to other animals, and the sweet scent of certain species may be nauseous or injurious to enemies*. The classification of the LONGICORNIA has given rise to considerable controversy, but the following is the arrangement adopted by Mr. C. J. Gahan in his recently published volume (page xi) on the Indian species; the PRIONINÆ being treated as a subfamily of the CERAMBYCIDÆ:—

A. Head in front oblique or subvertical; last joint of palpi not pointed at the end; anterior tibiæ not grooved beneath .... **Cerambycidæ**, [p. 185.

B. Head in front vertical or bent inwards well below the thorax; last joint of palpi pointed at the end; anterior tibiæ generally with a groove beneath .... **Lamiidæ**, p. 188.

Lacordaire adopts a division "Cérambycides aberrants," consisting of three tribes and four genera, *Thaumasus*, *Dynamostes*, *Spondylis*, and *Scaphinus*. The division, however, is not natural and is of no practical use; the only Indian genus *Dynamostes* falls naturally into the DISTENIINÆ among the CERAMBYCIDÆ.

The most aberrant species of all is, perhaps, the well known Brazilian *Hypocephalus armatus*, but as it does not come into our fauna, its position need not be discussed at length. Lameere and others have regarded it as a Clavicorn, but Dr. Sharp, who has studied the insect closely, is evidently right in believing that it really forms a subfamily of the CERAMBYCIDÆ, near the PRIONINÆ, from which it is distinguished by having the anterior coxal cavities closed behind, and by the peculiar articulation of the head. It is allied to two or three of the Indian species of Prioninæ.

Family 92. CERAMBYCIDÆ.

Head in front obliquely inclined, sometimes subvertical; clypeo-frontal sutures generally distinct, the clypeus as a rule relatively large; last joint of palpi not pointed at the apex; anterior tibiæ not grooved beneath.

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* Proc. Ent. Soc. Lond. 1901, p. 1.

The Indian species belonging to this family have been fully described by Mr. C. J. Gahan (Fauna of British India, Coleoptera, vol. i, 1906). The known Indian species belonging to the CERAMBYCIDÆ amount at present to close upon 400; the PRIONINÆ contain the largest representatives, among them being such species as *Rhaphipodus taprobanicus*, *Macrotoma fisheri*, etc.

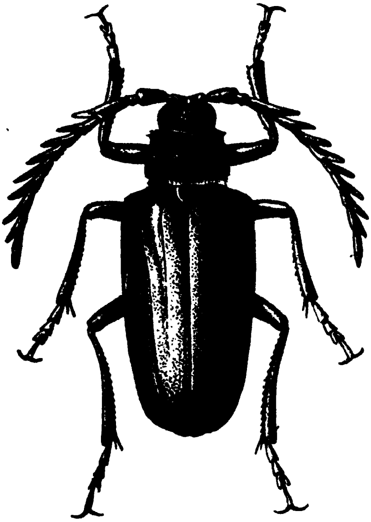


Fig. 85.—*Prionus ellioti* (natural size).

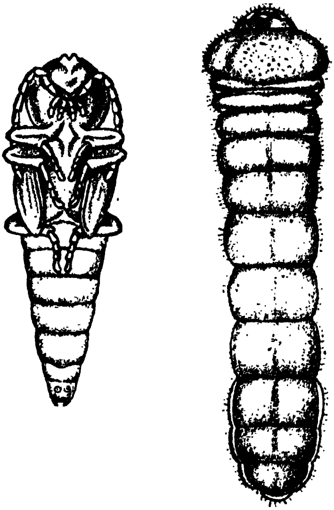


Fig. 86. — *Tetropium gabrieli*. Larva × 3½; pupa × 2½ (after Crawshay).

Mr. Gahan divides the family into the PRIONINÆ, which have the inner lobe of the maxillæ obsolete or very small, and the DISTENIINÆ, LEPTURINÆ, and CERAMBYCINÆ, which have it well developed. Full particulars of these divisions and their subdivisions will be found in Mr. Gahan's work (*l. c.* pp. 2–4 *et seqq.*).

The genus *Parandra* (which is not represented in the Indian fauna) ought, apparently, to form at least a separate subfamily, as the tarsi are distinctly pentamerous, the third joint being smaller than usual and not concealing the fourth.

In certain genera the antennæ are curiously tufted at the joints (e. g., *Phyodexia*, *Rosalia*, etc.), and the legs are sometimes hairy, or the posterior pair may be furnished with tufts; occasionally the femora are thickened and form a small plate. The same peculiarities are found in the LAMIIDÆ, but not, apparently, to so great an extent (e. g. *Aristobia*).

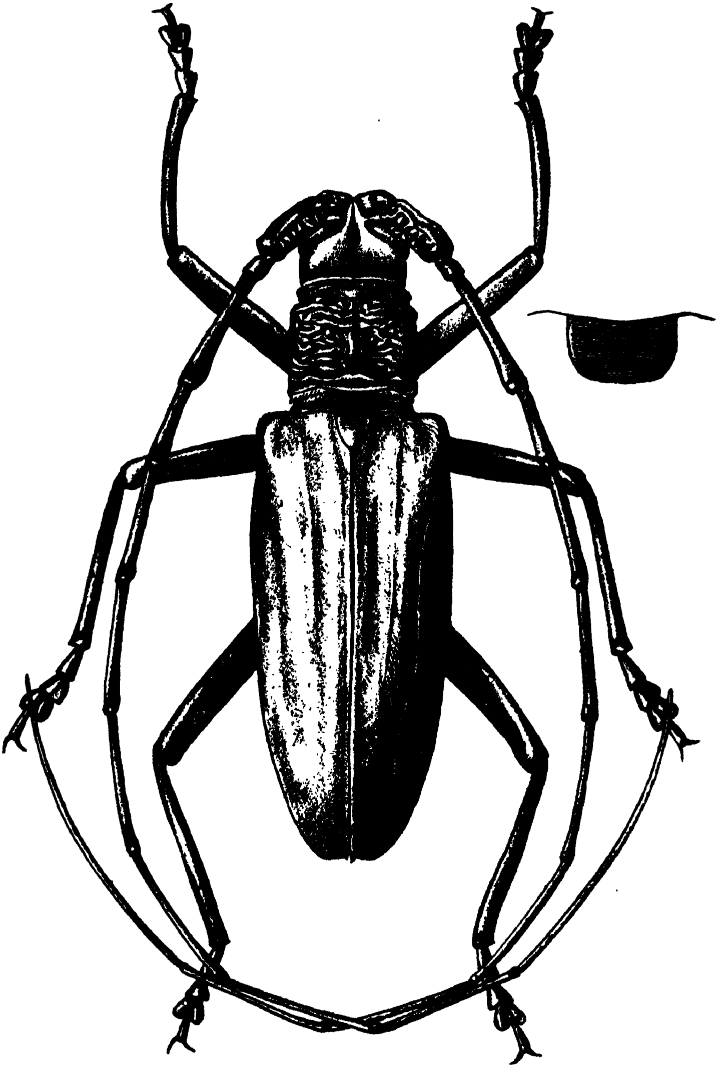


Fig. 87.—*Neocerambyx paris* (natural size). Stridulating organ enlarged.

Family 93. LAMIIDÆ.

Head in front vertical or bent inwards well below the thorax; last joint of the palpi pointed at the end; anterior tibiæ generally with a groove beneath.

This family, so far as the Indian fauna is concerned, contains a considerably larger number of species than the CERAMBYCIDÆ, and there are, roughly speaking, about 600 at present known. They are more highly specialised than the latter family and contain (apart from size) the most striking forms; the greater number of the cryptic or protected Longicorns belong to the Lamiidæ. Two groups may be characterised as follows:—

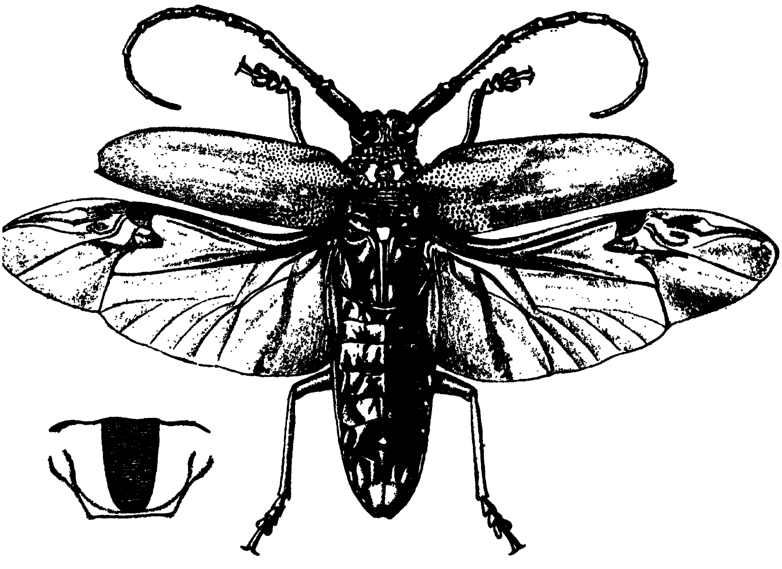


Fig. 88.—*Batocera rubus* (natural size). Stridulating organ enlarged.

A. Episterna of metasternum narrow .... LAMIINÆ.
B. Episterna of metasternum broad in front and narrow behind .... SAPERDINÆ.

Dr. Sharp (Camb. Nat. Hist. vi, p. 288) points out how the peculiar extension of the eyes round the antennæ, which is characteristic of the group, is accompanied by "very curious shapes of those organs, and not infrequently each eye is divided into two more or less widely separated parts, so that the insect has, on the external surface, four eyes."

Division 6. RHYNCHOPHORA.

The chief characters of the RHYNCHOPHORA are as follows:—Head usually prolonged into a rostrum or snout of varying length and thickness; antennæ straight, or geniculate, with a longer or shorter scape, and with a more or less distinct club; gular sutures not traceable; side sutures of the prosternum obsolete; tarsi apparently tetramerous, but really 5-jointed, the first three joints being always present (the third, as a rule, more or less strongly bilobed), the fourth, except in very rare instances (e. g. *Dryophthorus*), being rudimentary, and the last joint being very rarely absent (as in *Anoplus*). The testes are follicular, the follicles being roundish and stalked; six Malpighian tubes are present; the elytra are usually more or less distinctly striate, and the venter is composed of five segments, of which the first two are, as a rule, connate and immoveable. The wing-venation breaks down in this group, as the species in this respect incline both to Type I and Type II (see p. 40).

The larvæ, as a rule, are maggots quite destitute of legs, but these are present in the BRENTHIDÆ and also in certain ANTHRIBIDÆ. The SCOLYTIDÆ and ANTHRIBIDÆ have no distinct rostrum, and in *Platypus* the legs are slender, and quite different from the normal Curculionid type. As a rule, however, the above characteristics of the group hold good.

The theory of Leconte and Horn that the RHYNCHOPHORA are the lowest type of Coleoptera appears to be now regarded as quite untenable; the concentration of the nervous system alone suffices to prove that the group is a long way up the scale, though it is open to question whether Lameere is right in his account of their evolution. He regards the NEMONYCHINÆ (RHINOMACERINÆ), (which he considers to have had a common ancestor with the LARIIDÆ or to have been descended directly from primitive LARIIDÆ) as the common ancestor, "from which we pass to forms without labrum and with rigid maxillary palpi represented at first by divers types of ORTHOCERA, such as the ATTELABINÆ; from primitive ORTHOCERA the general stock of the CURCULIONIDÆ separated itself off, and under these may be classed the ERIRRHININÆ; from these last there detached themselves in different directions the OTIORRHYNCHINÆ, the CEUTHORRHYNCHINÆ, and the CALANDRINÆ, forming three superior types." The SCOLYTIDÆ, moreover, are regarded as merely a specialised form of the CALANDRINÆ, and not as a separate family.

A very large number of species are contained in the series; from 15,000 to 20,000 are now known, and they will probably in time be found to amount to more than ten times this number, as they have been comparatively neglected, and in any faunistic work on the group the number of new species is very great. Mr. Champion has recently been working out the Central American species in the "Biologia Centrali-Americana," and

Mr. Guy Marshall has undertaken the Indian species. Only about a thousand of the latter are at present known, but if the actual number existing were estimated at 10,000 it would probably not be very wide of the mark.

The classification of the RHYNCHOPHORA is in a more unsatisfactory condition than that of any other series of the Coleoptera, and is in much the same position as it was when Lacordaire (Gen. Col. vi, 1863, p. 2), after discussing the various systems proposed for the European members of the group, went on to say :—" Si les espèces européennes donnent lieu a d'aussi fortes divergences d'opinion, qu'est ce lorsqu'on trouve en présence des espèces exotiques ? " In fact no real classification can be said to exist.

Schönherr divides the group into two divisions, the ORTHOCERI (with the antennæ not geniculate), and the GONATOCERI (with the antennæ geniculate).

Thomson divides the RHYNCHOPHORA into two " Stirpes," the first characterised chiefly by having the ventral segments of the abdomen immovable, and the second about equal in length to the third, while in the second stirps the last three ventral segments are movable and the two first connate, the second being nearly always much longer than the third.

Leconte and Horn divide them chiefly on the structure of the pygidium, and the presence or absence of a peculiar ridge on the inner surface of the elytra, into which is fitted the ascending margin of the metathoracic epimera and ventral segments; this division is valuable in some respects, but is not accurate, as there are several important exceptions.

Sharp considers that only four families can be accepted, viz. :— ANTHRIBIDÆ, CURCULIONIDÆ, SCOLYTIDÆ (including PLATYPIDÆ), and BRENTHIDÆ. Of these the CURCULIONIDÆ contain by far the majority of the species and they ought to be much subdivided, but, unfortunately, no satisfactory characters on which to form the divisions have hitherto been discovered.

Bedel's classification (Faune Coléopt. du Bassin de la Seine, vi, p. 3) is in several points a satisfactory one, and, with the addition of the BRENTHIDÆ, might with reason be adopted :—

I. Maxillary palpi normal, flexible; labrum distinct; antennæ straight; legs not fossorial.

  i. Anterior coxæ globose; pygidium more or less exposed .... **Platyrrhinidæ (Anthribidæ).**

  ii. Anterior coxæ conical; pygidium covered .... **Nemonychidæ (Rhinomaceridæ).**

II. Maxillary palpi abnormal, rigid, conical, with the joints gradually smaller and tapering to a point at apex; labrum very rarely distinct, and if so, the legs fossorial.

  i. Legs not fossorial, anterior tibiæ not denticulate on their external margin; rostrum more or less pronounced, variable in length .... **Curculionidæ.**

ii. Legs fossorial, compressed; anterior tibiæ almost always denticulate or crenulate on their external border. Rostrum absent or rudimentary.
   1. First tarsal joint much shorter than the following joints taken together. **Scolytidæ.**
   2. First tarsal joint almost as long as all the following joints taken together; antennæ with only six joints .... **Platypidæ.**

If the BRENTHIDÆ are included they fall into the second section, with the maxillary palpi abnormal, rigid, and tapering, and may be distinguished further by the very elongate form, straight rostrum, and the moniliform and straight antennæ, which are, as a rule, without a club.

Mr. Guy Marshall, who has undertaken to work out the CURCULIONIDÆ of the Indian Fauna writes to the effect that he proposes to follow Faust, Sharp, and Ganglbauer, in accepting Lacordaire's general arrangement, rather than that of Leconte and Horn; in other words he would divide the Rhynchophora into four families ANTHRIBIDÆ, BRENTHIDÆ, CURCULIONIDÆ, and SCOLYTIDÆ. So far as the subdivision of the great complex of the CURCULIONIDÆ is concerned he has not yet attempted to map it out, beyond making a start on the ADELOGNATHI of Lacordaire; which are almost conterminous with the OTIORRHYNCHIDÆ of Leconte and Horn. In the circumstances it may be best to give some account of Lacordaire's classification of the CURCULIONIDÆ, when we come to refer again to that family.

We do not feel that we can agree with M. Lameere in considering the BRENTHIDÆ as allied to the CUCUJIDÆ and as belonging to the Clavicorn series. They are distinctly RHYNCHOPHORA, as is proved, not only by their general formation and pronounced rostrum, but also by the structure of the maxillary palpi; the fact that the only known larva, that of *Eupsalis minuta*, Drury, possesses legs, is a quite inadequate justification for Lameere's conclusion, especially as we know that larvæ both with and without legs occur among the ANTHRIBIDÆ. It appears, therefore, to say the least, premature to say that "the family of the BRENTHIDÆ cannot be attached to any of the families of the RHYNCHOPHORA. The larva alone suffices to show that the BRENTHIDÆ are not descended from the CURCULIONIDÆ, or the ANTHRIBIDÆ, or the BRUCHIDÆ, or the CHRYSOMELIDÆ"; and that they "are not PHYTOPHAGA, for they seem to have no direct parentage, either on the side of the ancestors of the CERAMBYCIDÆ or of the ancestors of the CHRYSOMELIDÆ." It should, however, be remembered that Lameere's theory with regard to the position of the BRENTHIDÆ is not quite a new one; several of the old entomologists regarded them as transitional between the CURCULIONIDÆ and the old XYLOPHAGA, and Imhoff (Vers. Einführ. Stud. Col. ii, p. 159, quoted by Lacordaire, vii, p. 404) makes his 9th section of the Coleoptera "Baculicornia" comprise the following families:—COLYDIIDÆ, CRYPTOPHAGIDÆ, CUCUJIDÆ, RHYSODIDÆ, BRENTHIDÆ, PARANDRIDÆ, and HYPOCEPHALIDÆ.

As Mr. Guy Marshall, as stated before, is working at the Indian RHYNCHOPHORA, it is best to follow his proposed arrangement and adopt four families only:—PLATYRRHINIDÆ (ANTHRIBIDÆ), BRENTHIDÆ, CURCULIONIDÆ, and SCOLYTIDÆ (IPIDÆ). It is doubtful whether the NEMONYCHIDÆ (RHINOMACERIDÆ) should not be considered as separate; but in this case the RHYNCHITIDÆ might also have a claim to be regarded as distinct. It is, however, largely a matter of choice at present. The four families here given may be distinguished as follows:—

I. Antennæ rarely clavate and never strongly so; rostrum straight, in the same plane as the upper surface	**Brenthidæ**, p. 192.
II. Antennæ more or less clavate, usually strongly so.	
i. Maxillary palpi resembling those of the other Coleoptera, not rigid; labrum distinct; legs not fossorial; rostrum short, broad, and flat	**Platyrrhinidæ (Anthribidæ)**, [p. 193.
ii. Maxillary palpi short, conical, and rigid.	
1. Legs not fossorial; rostrum more or less pronounced, but variable	**Curculionidæ**, p. 194.
2. Legs fossorial; rostrum practically absent or rudimentary	**Scolytidæ**, p. 197.

It seems strange that, in spite of their peculiar facies, it is very hard to find any definite character on which to separate the BRENTHIDÆ as a whole from the other Rhynchophora. Lacordaire (Gen. Col. vii, p. 399) points out this fact and says that, although no rigid formula can be applied to them, yet the combination of characters gives them a right to form as distinct a family as the CURCULIONIDÆ.

Family 94. BRENTHIDÆ.

Form elongate and narrow; head elongate, as a rule constricted behind, eyes rounded and small, labrum wanting; rostrum straight, in the same plane as the upper surface, sometimes almost as broad as the head; prothorax very elongate; elytra entirely covering the pygidium; legs stout, femora clavate. Larvæ (as far as known) with short legs.

From 800 to 1000 species are contained in this family, which are, with very few exceptions, confined to tropical countries. They are very widely distributed, but only a few have hitherto been described from the Indian region, though they are probably well represented.

Lacordaire divides the group into two subfamilies as follows:—

I.	Antennæ 11-jointed, regular in form	BRENTHINÆ.
II.	Antennæ 9- (rarely 11-) jointed, irregular in form ..	ULOCERINÆ.

Apart from these differences the first section is characterised by a large amount of sexual dimorphism, which appears to be very slight or absent in the second. In the BRENTHINÆ the rostrum and mouth-parts are very different in the males and females; in the former sex the rostrum may be broad and more or less rudimentary, or, on the other hand, as long as, or longer than, the elongate body; in the first case the mandibles are very strong and powerful. The slender rostrum of the female is well adapted for its purpose of boring holes in wood in which the eggs are deposited singly.

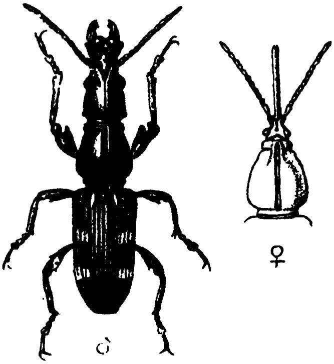


Fig. 89.—*Prophthalmus potens*, male, with head and thorax of female.

Although the family as a whole consists of wood-feeders, there are one or two genera which appear to be predaceous and to feed on various larvæ, but not much seems to be known on this point.

Family 95. PLATYRRHINIDÆ (ANTHRIBIDÆ).

Antennæ not geniculate, sometimes long; head prominent, not deflexed; rostrum broad and flat, and often so short as to be indistinct; labrum distinct, quadrate, fringed with hairs; third joint of the tarsi variable, bilobed, but often small and much concealed within the apex of the second joint; pygidium exposed; propygidium deeply grooved in the middle.

About 800 to 1000 species are contained in this family, which are, for the most part, tropical; in the temperate zones they are rare. Several of the species with long antennæ closely resemble Longicorns of the family LAMIIDÆ. Very little is known of their life-history, but they frequent old wood, old hedges, and boleti. In some species the larvæ have legs, in others they are wanting, while occasionally (e. g. *Choragus*) they are represented by three pairs of tubercles or pseudopods. This being the case, it is impossible to divide the RHYNCHOPHORA on the characters of the larvæ, as has been suggested. The species are often very prettily variegated in shades of black, brown, grey, and white.

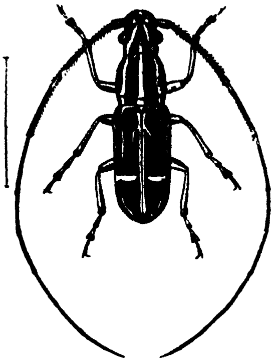


Fig. 90.—*Xenocerus anchoralis*.

A considerable number of the known genera and species occur in the Indian fauna; of these the genus *Tropideres* appears to have the widest range, being found in Europe, North and South America, South Africa, and also in Ceylon. The members of the Indian genus *Araeocerus*, like the European *Choragus*, have the power of leaping more or less strongly developed.

The greater part of the species of which the habits are known live in dry branches or twigs, or in large seeds of various plants, and in these undergo their metamorphoses; the larvæ of *Brachytarsus*, however, appear to feed on COCCIDÆ (Scale-insects): they are almost the only species of RHYNCHOPHORA which are known to be carnivorous in any stage of their existence.

Family 96. CURCULIONIDÆ.

Rostrum variable, but, except very rarely, distinct, and as a rule much pronounced; palpi very small, short, concealed and rigid (except in the RHYNCHITINÆ *and* NEMONYCHINÆ, *in which they are more or less flexible and exserted); labrum absent (except in the* NEMONYCHINÆ, *in which it is visible, but minute). Antennæ for the most part geniculate.*

At present this is a vast and hopeless complex containing some 20,000 to 30,000 species. As a rule the members of the family are easily distinguished by the pronounced rostrum and geniculate antennæ, but exceptions occur, and very rarely (*e. g.*, in such Australian genera as *Amycterus*, *Psalidura*, *Acantholophus*, etc.)

the rostrum is so short as to be almost absent. In the vast majority of species the palpi are very remarkable for their minuteness and rigidity; this is due to their position at the apex of the rostrum, a point often overlooked by the ordinary student; but in *Nemonychus* and a few other genera they are more or less flexible.

The life-history of many members of the group is well known. They are entirely vegetable feeders and the larvæ are legless maggots; occasionally they do enormous damage to crops of various kinds, and no part of the plants, from the root to the flower, is free from attack. Their habits are very varied; certain species form galls, others form cocoons resembling galls; a large number undergo their transformations in the capsules of various plants, while others in the larval state mine the parenchyma of the leaves. Species of *Attelabus* and *Rhynchites* lay their eggs simply on the leaves, attaching them to their surface by a viscous substance, and then roll the leaves over them so as to form a nest or shelter. In other cases the female deposits her eggs in the freshly set fruits of Pomaceæ or Amygdalaceæ, or in fresh shoots

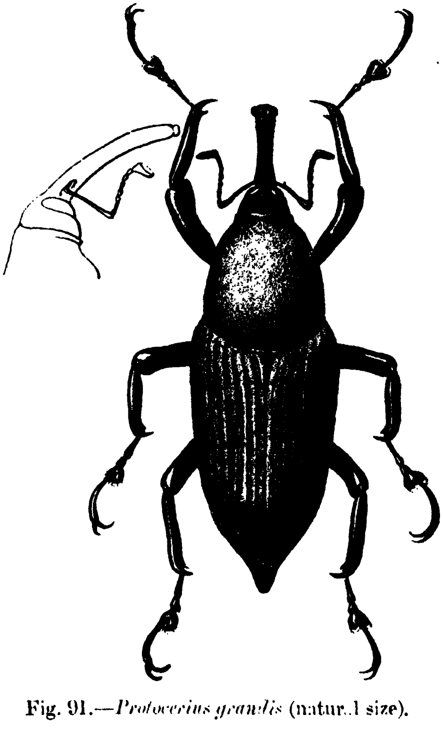


Fig. 91.—*Protocerius grandis* (natural size).

of deciduous trees; in such cases she partly cuts through the stem, so that the fruit or shoot falls at about the time that the larva is full grown and ready to undergo its further transformations, which take place underground.

A large number of Curculionid larvæ change to pupæ under the earth, but this is by no means always the case; the species belonging to the very large and universally distributed genus *Apion*, for instance, as far as is known, undergo all their transformations in the flower-heads, seed-vessels, pods, leaf-stems or stalks in which they were originally hatched. The COSSONINÆ are wood-feeders, and are of interest in that two-thirds of the described species belong to insular faunas; this was especially brought out by Mr. Wollaston who described one genus *Mycroxylobius*, containing thirteen species, all peculiar to St. Helena, and considered them to be the archaic remnants of an ancient fauna in that detached island.

A few genera, e. g., *Bagous*, *Eubrychius*, *Litodactylus*, etc., are subaquatic, and the species of the two latter genera swim rapidly with their hind legs like a frog or a Dytiscid.

Although the members of the family, however different, are, almost without exception, easily identified as belonging to it, yet there is an enormous diversity of form and sculpture. Perhaps some of the most extraordinary forms are found among the ATTELABINÆ and their allies, some of which are armed with long thorns or spines at the sides.

Certain genera possess an extraordinarily hard integument which is calculated to protect them effectually against enemies; this is notably the case with the genus *Brachycerus*. I have made experiments with dry and hollow specimens of a comparatively small species of this or a closely allied genus, and have found that when laid upon a board with another board above they would bear a weight of more than a quarter of a hundredweight without giving or breaking; on ordinary ground and in a living state they would, of course, bear much more.

The clothing of the upper surface varies a great deal. The surface is often quite bare, but it is the rule rather than the exception for certain parts of the upper and under surface, if not all, to be covered with scales of varied shape and proportions; some of these are very brilliant, and render their possessors very striking objects; larger or smaller hairs or setæ are often present.

We have already alluded to the fact of the jaws being situated at the end of the rostrum; as a rule their motion is horizontal, but in the case of *Balaninus* it is vertical. The character is so peculiar that it might with reason be held to constitute the BALANININÆ a separate division or subfamily.

The difficulty of making any satisfactory arrangement of the CURCULIONIDÆ may be gathered from the fact that Lacordaire considers it to consist of no less than eighty-one tribes, most of which are divided into groups of varying number. In his arrangement (Gen. Col. vi & vii) he begins by adopting two leading divisions or "legions":—

I. Maxillæ covered by the mentum except occasionally at the base; sub-mentum without peduncle .... CURCULIONIDÆ ADELOGNATHI.
II. Maxillæ not covered by the mentum; sub-mentum as a rule plainly pedunculate .... CURCULIONIDÆ PHANEROGNATHI

These are again divided and subdivided into "cohorts,' "phalanxes," "sections," and "tribes" in bewildering succession. Lacordaire, moreover (*l. c.* vii, p. 1, note), confesses that he cannot hide from himself the weakness of one of his chief divisions, which apparently bristles with exceptions, so that it is impossible to accept it as final, and yet it must be allowed that no one has, as yet, really superseded his arrangement. In the present state of own knowledge, then, it would seem that the general question of the classification of the family must be left in abeyance. The discovery of new forms is perpetually altering our ideas of the Coleoptera, and in no group will new forms be more constantly discovered than in the one under consideration.

Family 97. SCOLYTIDÆ (IPIDÆ).

Head variable in form, with the rostrum short and broad and, in many cases, practically absent; mandibles stout, curved, more or less denticulate on their inner side; prothorax variable, but usually large and as broad as the elytra: anterior coxæ usually contiguous; legs compressed, anterior tibiæ almost always denticulate or crenulate on their outer side; tarsi variable, last joint long.

The members of this family are for the most part small and cylindrical insects, which are eminently adapted by their shape for their wood- and bark-boring habits; in very rare cases, as in the curious male of *Xyleborus dispar*, the form is more or less globose. A very few of the species are known to feed in the stems of plants or in dried fruits; those belonging to the genus *Thamnurgus*, Eich., for instance, live in the stems of *Euphorbia*, *Delphinium*, and other plants. As a rule they burrow between the wood and the bark, but some species bore into the solid wood (*Trypodendron*, etc.), and the family as a whole is very injurious. The insects have been defended on the ground that they only attack decaying and doomed trees, but the truth appears to be that sound trees are first penetrated by the perfect insects and thus become weak and sickly, and the larvæ of these and other species of wood-feeding beetles complete their destruction (*v.* Brit. Col. v, p. 400).

The larvæ of the SCOLYTIDÆ very closely resemble those of the ordinary RHYNCHOPHORA; the head, perhaps, is a little longer and stronger, and the mandibles, as might be expected, somewhat longer and more developed; the larva of *Platypus* is somewhat different from the ordinary Scolytid larvæ, being more elongate and cylindrical and terminating in a short spine.

About 1500 species are known as belonging to the family. Most of the principal genera are represented in India and Ceylon, and, in view of the ravages they commit on forest-trees, a knowledge of the habits of these insects and of the means of reducing or exterminating them is of the utmost importance for all who are connected with the Department of Woods and Forests in India and Burma.

It may, perhaps, be of advantage in this connection to quote the general description of the life-history of the SCOLYTIDÆ, which was kindly communicated to me by Mr. W. F. Blandford for my work on the British Coleoptera (v, p. 401):—

"In the fact that the female enters the trunk or plant to lay her eggs the SCOLYTIDÆ differ from all other RHYNCHOPHORA by which the eggs are deposited from the outside.

"The process of establishing a brood begins in every case by the formation of a vertical entrance-hole through the bark, which, in the wood-boring forms, is continued deeply into the tree, but which, in the bark-feeding species, only reaches at most the surface of the wood.

"To begin with the latter:—The entrance-hole is usually gnawed by the mother; but some species are polygamous, and in these the male performs the operation. He then hollows out a small irregular cavity—the brood-chamber; there certain females betake themselves, and, after impregnation, commence the 'mother-galleries' at the junction of wood and bast. In the monogamous species the female is fertilized in the entrance-passage or just outside it. From the termination of the entrance-hole the 'mother galleries' run—sometimes two in number; in the polygamous species they form a star-shaped system radiating from the brood-chamber. The eggs are laid alternately on the right and left of the galleries in small excavations from which the larval galleries start. Occasionally they are laid in a clump, and the larvæ feed in an irregularly advancing column without forming distinct galleries. The dead body of the mother is usually to be found at the end of her gallery, and it may thus often serve as a clue to a species which is met with in the larval state.

"The larval galleries usually commence at right angles to the 'mother-galleries'—at least at their middle; but they often change their direction irregularly, the different shapes of the borings being characteristic of the species. Their length is variable, and depends on the extent to which they are channelled in the wood. In some species the galleries, which score the wood deeply, are only about one inch in length, while in others they are often four or five inches long and sometimes very irregular; they end in an oval pupal chamber, from which the imago escapes by gnawing a flight-hole. Besides these holes others are made at intervals along the 'mother-galleries' for ventilation.

"In the solid-wood-borers the females alone make the entrance-holes, which lead sometimes to tangential galleries from which the larval galleries start, as in *Trypodendron*; or they form a series of repeatedly bifurcating passages, as in *Xyleborus*, in which larvæ, pupæ, and immature beetles occur together. In the second case there are no larval galleries, and the larvæ appear to feed on sappy exudations or on the mycelium of a fungus growing on the walls. In the solid-wood-boring forms pupal chambers and flight-holes are not found, the imagos emerging by the entrance-tunnel.' In certain genera, as *Xyleborus*, the males are apterous, and do not quit the tree in which they are bred: here they fertilize the females immediately after metamorphosis."

The PLATYPINÆ are sometimes regarded as a distinct family. As Dr. Sharp has shown (*l. c.* p. 295), they are the most aberrant of all RHYNCHOPHORA, the head being remarkably short and flat in front, with the mouth placed on the under surface of the head; there is no trace of a rostrum; the tarsi are very slender and elongate, with the third joint not lobed and the true fourth joint visible. The life-history of *Platypus cylindrus* has been fully worked out by Dr. Algernon Chapman (Ent. Monthly Magazine, viii, pp. 103-132). The genus *Platypus* is for the most part exotic, and is represented by several species in the Indian region, particularly in Ceylon. Retaining the PLATYPINÆ as a subfamily only, the SCOLYTIDÆ may thus be divided:—

I. First tarsal joint much shorter than the remaining joints united; sides of prothorax not emarginate for the reception of the legs; head never broader than prothorax	SCOLYTINÆ.
II. First tarsal joint almost as long as the remaining joints united; sides of prothorax emarginate for the reception of the legs; head broader than prothorax.	PLATYPINÆ.

The two following families, the AGLYCYDERIDÆ and PROTERHINIDÆ, are of uncertain position. They are both placed doubtfully by Ganglbauer under the RHYNCHOPHORA, whereas Kolbe assigns the former a position between the MYCETOPHAGIDÆ and CATOPROCHOTIDÆ on the one hand and the ADIMERIDÆ and COLYDIIDÆ on the other, and places the latter without question under RHYNCHOPHORA. As a matter of fact *Aglycyderes* cannot be forced into any group, and the 3-jointed tarsi appear to preclude it from being regarded as a Curculionid. The same applies to *Proterhinus*, but in this case the female has a distinct rostrum and presents a decidedly Rhynchophorous appearance. It is, however, best to consider both as abnormal, in the present state of our knowledge. Neither of them is represented in the Indian fauna.

[Family 98. AGLYCYDERIDÆ.]

Head short and very broad, triangular, considerably broader than the apex of the prothorax, without trace of a rostrum; antennæ long, eleven-jointed, submoniliform; prothorax almost circular; legs rather short and stout, tarsi three-jointed.

This family contains one genus, *Aglycyderes*, comprising two or three species from the Canary Islands, New Zealand, and New Caledonia; one of these is believed to live in stems of Euphorbia. Westwood (Thesaurus Entomologicus, p. 106) considers the tarsi to be 4-jointed, whereas Sharp thinks it by no means clear that the very minute knot which Westwood regarded as the third joint is more than the articulation of the elongate terminal joint. The insect was referred by Westwood to the Anthribidæ, and it certainly bears a superficial resemblance to species belonging to the Anthribid genus *Zygænodes*; the likeness, however, is evidently only superficial, and is chiefly confined to the very peculiarly shaped head. Wollaston (Cat. Coleop. Ins. Canaries, p. 384), after discussing the doubtful affinities of the insect, concludes by saying that upon the whole it seems to combine the two opposite extremes of the Rhynchophora (as represented by the Scolytidæ and Anthribidæ) with certain setose genera of the Colydiidæ (such as *Sarrotrium* and *Diodesma*), in which the body is hispid and the tarsi 4-jointed. In any case the genus is abnormal, but it appears to be more nearly allied to the Rhynchophora than to any other group.

[Family 99. PROTERHINIDÆ.]

Elongate oval, roughly sculptured insects, with the head subtriangular, scarcely produced in the male, but with a distinct short rostrum in the female; eyes very prominent; antennæ long and slender; pronotum with the sides more or less rounded; legs stout, especially in the female; tarsi three-jointed, the second joint lobed; maxillæ and ligula entirely covered by the mentum.

This is one of the strange families described by Dr. Sharp from Hawaii. It consists of the single genus *Proterhinus*, which is confined to the Hawaiian Islands; the species and individuals are numerous, and live on dead wood in the native forests. The family certainly seems to have considerable affinities with the Rhynchophora, but cannot be included under them at present. According to Sharp, a very minute true third joint is to be found at the base of the lobes of the second joint of the tarsi.

Sub-Order III. *LAMELLICORNIA.*

The LAMELLICORNIA are chiefly known by the highly differentiated club of the antennæ, from which they take their name, this being entirely different from what is found in any other group. The joints are lamellate and unilaterally extended at the apex; they are articulated together, and the apposed faces of the lamellæ or leaves, which are freely exposed to the air, when the beetles are in motion, are provided with minute sensory pits or hairs or both. Certain senses, therefore, are highly developed in the LAMELLICORNIA: whether these are smell and hearing, or something of which we know nothing, is quite uncertain (see p. 27). In the LUCANIDÆ the lamellæ are immovable and the club is more or less pectinate; in the MELOLONTHINÆ they can be applied together in close contact, or opened like the leaves of a book, while in some COPRINÆ they are received into the first joint, which is hollow. The other most notable characters of the group are the enormous development of the mandibles in the male LUCANIDÆ and the horns and excrescences in the DYNASTINÆ, and, to a lesser extent, in one or two other sections, and the structure and characteristics of the larvæ. The concentration of the ganglia or nerve-centres is also remarkable in the group, although it is by no means uniform. The whole of these characters, taken together, in conjunction with the habits of various species, both in the larval and the perfect state, appear to be quite sufficient to mark off the LAMELLICORNIA as a separate series, and they are here regarded as forming a distinct complex, having an equivalent value with the ADEPHAGA and the POLYCERATA, or POLYMORPHA of Sharp, who adopts the same arrangement.

Ganglbauer includes the LAMELLICORNIA under the general term of "SCARABÆIDÆ" as a "Familienreihe" of his sub-order POLYPHAGA, and he only recognizes two sub-orders altogether.

Kolbe assigns all the families of the LAMELLICORNIA to his division HETEROPHAGA, but he places the PASSALIDÆ in a different group from the rest, near TROGOSITIDÆ, and he also adds the SYNTELIIDÆ.

Lameere, who adopts three series—CARABIFORMIA, STAPHYLINIFORMIA, and CANTHARIDIFORMIA—places the LAMELLICORNIA under the last of these, which includes all the remainder of Ganglbauer's POLYPHAGA.

Lacordaire forms the group into two distinct families—"Pectinicornes," containing the LUCANIDÆ and PASSALIDÆ, and "Lamellicornes," containing the remainder of the group.

We have above mentioned the chief characteristics of the group; the following, however, may be recapitulated:—Gular suture distinct; side sutures of the thorax distinct; testes roundish and stalked; four Malpighian tubes present; body usually more or less convex and often strongly rounded; legs, in some cases, very peculiar, the front pair being, for the most part, fossorial; tarsi 5-jointed, very rarely 4-jointed; in certain genera of SCARABÆIDÆ the anterior tarsi are wanting, either in both sexes or in the male only. The structure of the wing-venation is variable in the group, wings being found with the venation of Type II and Type III (pp. 40–42); the Cantharidiform venation, however, appears to prevail.

We have before referred to the concentration of the nervous system and its variability, which is very remarkable. A full account has been given by Blanchard (Ann. Sc. nat. 3 sér., Zool. v, 1846), and Brandt (Horæ Soc. Ent. Ross. tome xiv, 1878, xv–xvii) has deal with the subject in detail. Ganglbauer (Münch. Kol. Zeits. i, 1903, p. 312), quoting from these, says that as regards the nervous system the LUCANIDÆ are the most primitive, as in these the abdominal chain consists of six or seven separate ganglia. In the PASSALIDÆ, according to Blanchard, the abdominal ganglia, as in most of the SCARABÆIDÆ, are connate, but present a longer complex than is found in the latter; in the GLAPHYRINÆ (among the SCARABÆIDÆ) six abdominal ganglia can be traced, but they are approximate; in the rest of the SCARABÆIDÆ, according to Brandt, all the abdominal ganglia are united into one complex with the metathoracic ganglion. In the GEOTRUPINÆ the mesothoracic and metathoracic ganglia approach one another very closely; in the CETONIINÆ, RUTELINÆ, and MELOLONTHINÆ these ganglia are united; in the RUTELINÆ the prothoracic ganglion comes very near to the mesothoracic ganglion, and in the MELOLONTHINÆ all the ganglia of the thorax and abdomen (including the prothoracic) are narrowed to a simple complex; the highest point is reached in *Rhizotrogus* and *Lachnosterna*, in which the infra-œsophageal ganglion is brought into the same complex.

The larvæ of the group are discussed, and several of them beautifully figured, by Schiödte (Naturhist. Tidsskrift (3) ix, 1874, pp. 227–276, pls. vii–xix). They are broad, fleshy, whitish or dirty white grubs, and are for the most part wider towards the apex of the abdomen. The head is chitinous and rounded, generally without ocelli; the antennæ are inserted at the sides of the head on a projection which looks like a first joint; the joints vary in number from two to four; the thoracic and abdominal segments do not materially differ. The stigmata are conspicuous, and there are nine pairs in all, the first situated at the sides of the prothorax and the other eight in the first eight abdominal segments, in a line; the legs are comparatively long, with the tarsi very small or only represented by a small claw; in the PASSALIDÆ the posterior pair is rudimentary; there are no cerci or anal appendages. In spite of the length of the legs, the larvæ have but little power of progression, as the apex of the body is curved. The larvæ of the PASSALIDÆ, however, unlike those of the other known LAMELLICORNIA, are active, with a straight body, and the four ambulatorial legs are long, so that they can walk fairly quickly. A few (CETONIINÆ) can crawl upon their backs. They feed on vegetable substances, dung, and, in some cases, on other animal matter; those that live in wood or at the roots of plants sometimes take three years or more to come to maturity, but many of the coprophagous species take longer than these phytophagous species, although, as a rule, the former take a shorter time and, in many instances, go through their metamorphoses in a very brief period (*v.* Chapuis et Candèze, Cat. des Larves des Coléoptères, pp. 112-115).

As the Lamellicornia are one of the most important of the Indian groups of Coleoptera, it may be of service to quote the table of larvæ given by Erichson, and followed by Chapuis and Candèze and other authorities. It must, however, be borne in mind that it is based on the study of only a small number of types, very few, if any, of these being Indian:—

I. Lobes of maxillæ connate (Pleurosticti).
  i. Mandibles obtusely dentate at apex and furnished with transverse striæ on their posterior surface.
    1. Ninth segment of abdomen divided in the middle by a transverse furrow, which makes the segment appear as if divided into two .... Dynastinæ.
    2. Ninth abdominal segment simple .... Cetoninæ.
  ii. Mandibles furnished with a small tuft at apex, posterior surface not furrowed; ninth abdominal segment as in the Dynastinæ ...... Melolonthinæ.
II. Lobes of maxillæ separate (Laparosticti).

The Laparosticti may be further divided as below; the joints of the antennæ are reckoned apart from the basal support, which has apparently been counted in the number by some authors. We have not here quite followed Chapuis and Candèze, as their views seem in one or two points to be at variance with those of Schiödte, whose work is most accurate.

i. Segments divided into transverse folds.
  1. Antennæ composed of four joints.
    A. Mandibles distinctly tridentate .... Coprinæ.
    B. Mandibles obtusely and sometimes obscurely bidentate.................. Aphodiinæ.
  2. Antennæ composed of three joints.
    A. Mandibles with four teeth on each, the last being the largest, bifid at apex .... Geotrupinæ.
    B. Mandibles with two or three teeth on each .... Troginæ.
ii. Segments single, without transverse folds.
  1. Antennæ composed of two joints; posterior legs very small .... Passalidæ.
  2. Antennæ composed of three joints; all the legs strongly developed .... Lucanidæ.

The larvæ are especially remarkable for their stridulatory powers; the organs for producing the sound appear to be situated in some cases on the mandibles and in others partly on the coxæ and trochanters. Not much has been added to our knowledge of the stridulatory organs of the larvæ since the work of Schiödte was published, but numerous further observations with regard to the stridulatory organs of the perfect insects have been made by Mr. C. J. Gahan (Trans. Ent. Soc. Lond. 1900, pp. 433–452, pl. vii) and Mr. G. J. Arrow (Trans. Ent. Soc. Lond. 1904, pp. 709–750, pl. xxxvi). Mr. Gahan's is a general paper, but he describes several species of LAMELLICORNIA as possessing vocal organs in the perfect state. Mr. Arrow's important paper is entirely devoted to the LAMELLICORNIA, and is full of interesting details, but we have no space here to go fully into the question. We quite agree with him when he says that "the special importance of stridulation in the Lamellicorns is probably in part due to a mental development higher than that of most other beetles, and evidenced, not only by the concentration which here occurs in the nervous system, but in certain cases by a degree of social organization which was, until quite recently, hardly suspected, although the elaborate instincts of certain members of the group attracted attention in very early times, and procured from the ancient Egyptians peculiar honours for the sacred Scarabæus and other beetles of the same family."

Apart from mere structure, it is the possession of these instincts, and the greater development of the nervous organization, as evidenced by the stridulatory powers of the larvæ, that induce us to regard the Lamellicorns as in the first place a perfectly separate series or sub-order, and in the second place as holding the highest position in the order of the Coleoptera. It should, however, be noticed that the stridulatory powers are by no means so general in the perfect insects as in the larvæ, although occasionally the imago has strong vocal powers (as in *Trox*) which are quite wanting in the earlier stage.

We really know very little of the phylogenetic history and the interrelation of the group, and authors are greatly at variance with regard to it. Thus Lameere (Ann. Soc. Ent. Belgique, xliv, 1900, p. 371) says that, as the LUCANIDÆ possess five visible ventral segments, they cannot be the ancestors of the SCARABÆIDÆ, which possess six; Ganglbauer (Münch. Koleopt. Zeitsch. i, 3, 1903, p. 312) points out that Lameere is here assigning too high a phylogenetic value to the number of the abdominal segments; these, he says, are five in number, if the elytra entirely cover the abdomen, whereas they are more than five if the apex of the abdomen is uncovered, and he regards the unshortened elytra as characteristic of the primary type.

Again Ganglbauer believes that the extraordinary development of the thoracic horns, so conspicuous in many of the males of the large series, is derived from forms that did not possess the sexual dimorphism; whereas Lameere is of opinion that the reverse is the case, and that therefore the DYNASTINÆ are the primitive Pleurostict forms. The latter author regards the modifications of sexual dimorphism as the key-note (*Leitmotif*) of the evolution of the Lamellicorns; whereas Ganglbauer would find it in the position and surroundings of the abdominal stigmata. Both, however, agree that the LUCANIDÆ and SCARABÆIDÆ are descended from one stock, but Ganglbauer believes that the latter are much higher in the scale than the former.

Between 14,000 and 15,000 species of LAMELLICORNIA have been named and described; of these the PASSALIDÆ comprise some 400 or 500 species, the LUCANIDÆ 500 or 600, while the SCARABÆIDÆ contain the remainder. About 1300 in all are found in the Indian region. The smallest subfamily of the SCARABÆIDÆ in point of numbers is the DYNASTINÆ: these number only 1000 species, of which only 46 occur in India. The MELOLONTHINÆ number about 4000, the RUTELINÆ 1500 to 2000, and the CETONIINÆ about 1600; the Laparostict LAMELLICORNIA as a whole contain about 5000 species.

The three families PASSALIDÆ, LUCANIDÆ, and SCARABÆIDÆ are distinguished as follows by Arrow (Fauna of British India. Lamellicornia, part i, p. 22):—

I. Antennæ not elbowed, the joints of the club not very thin, brought together by rolling up ...... **Passalidæ,** [p. 205.

II. Antennæ elbowed, not capable of rolling up, the joints of the club not very thin nor coadapted .. **Lucanidæ,** [p. 207.

III. Antennæ not elbowed nor capable of being rolled up, the joints of the club very thin and closely coadapted .... **Scarabæidæ,** [p. 209.

Family 100. PASSALIDÆ.

Form flat (very rarely cylindrical): antennæ pectinate, but not elbowed or geniculate; labrum not connate with the clypeus, mobile: mentum emarginate, the emargination being filled with the ligula; mandibles the same in both sexes, not strongly developed; intermediate coxæ almost globular; elytra entirely covering the abdomen.

So far as the imagines are concerned, this is an exceedingly uninteresting family, consisting of some five hundred species of singularly uniform appearance, being large, more or less shiny, depressed, elongate-oblong insects, with the elytra marked with (as a rule ten) strong longitudinal sulci or furrows; a few species are more or less cylindrical. The family is not represented in Europe, and one species only, *Passalus cornutus*, F., is found in America north of Mexico; it is, however, not uncommon in the tropical regions of both the Old and the New Worlds. The genera are well represented in the Indian region, although comparatively few species appear to have been recorded.

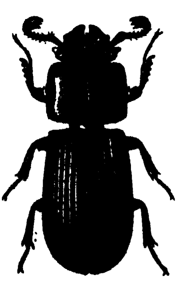


Fig. 92.
Passalus darjeelingi
(natural size).

The larvæ of the PASSALIDÆ appear to be very remarkable both as regards their structure and their life-history. They are more slender than the larvæ of the LUCANIDÆ, and have the surface of the segments smoother, the head also being much smaller. The chief peculiarity, however, lies in the legs. The first and second pairs are comparatively long, but the posterior pair is rudimentary, consisting of a very short coxa and a trochanter about six times as long as this. The latter is modified as a plectrum, which is arranged so as to strike or scratch a stridulating area on the coxæ of the second pair of legs; occasionally it is furnished with claws or digits, but more often it is simple.

These larvæ differ also from those of the LUCANIDÆ in the formation of the anal opening, which is transverse, with the upper lips longitudinally split: in this they approach certain of the SCARABÆIDÆ. As a matter of fact the PASSALIDÆ, as pointed out by Dr. Sharp, are more closely allied to the SCARABÆIDÆ than to the LUCANIDÆ; their nearest allies appear to be the TROGINÆ and GEOTRUPINÆ, which are probably the most ancient of the LAMELLICORNIA.

The PASSALIDÆ appear to have reached a higher pitch of family organization than is found elsewhere among the Coleoptera. The following account of the observations of Dr. Ohaus, quoted from Mr. Arrow's paper before referred to (Trans. Ent. Soc. Lond. 1904, p. 734) will serve to prove this:—

"Having had considerable success in rearing the larvæ of the LAMELLICORNIA, Dr. Ohaus tried to rear those of PASSALIDÆ in the same way, many species being very common in the neighbourhood of Petropolis; but to his surprise they invariably died in a few days. Determined to discover the reason of his failure, he devoted himself for a time to the investigation of their natural conditions of life, and soon observed that when a rotting trunk contained tunnels inhabited by the larvæ, a pair of adult beetles was invariably to be found at the end of each tunnel, each pair accompanied by from two to seven young ones. Transferring the entire family to his breeding-cage, he found that they then fared perfectly well. If individuals from different places were put together they refused to settle down, and soon died or killed each other, but by keeping each family by itself he had no difficulty in following out their history. The adults were usually occupied in disintegrating the wood at the far end of the burrow and chewing it into a soft condition ready for the larvæ, the condition of whose jaws seems to render them incapable of procuring their own food. Even when kept apart from their parents and the material prepared by the latter supplied to them, they did not prosper, and Dr. Ohaus considers it probable that a digestive secretion is mixed with it before it is given to them. The beetles devote constant attention to their offspring from the time they leave the egg until full maturity is reached, for even after the young beetle has assumed its final shape the jaws are for some time too soft for it to feed without parental assistance. Both larval and adult **Passalidæ** stridulate loudly and constantly, and in these organized communities it seems to be undeniable that the vocal powers serve the purpose of intercommunication. Dr. Ohaus records an interesting episode which may be quoted as a proof of this.

"Breaking up a log in search of larvæ of another group he disturbed a community of **Passalidæ** consisting of the parents and six larvæ. Not wishing to keep them, he put them on the ground and went on with his search. Having finished this he was preparing to leave when another log near by attracted his attention, and he turned it over. Beneath it were the two beetles and four of their brood, while the other two were making for the same shelter as fast as intervening obstacles would allow. The chirping of the whole party had all the time been audible, and my friend is convinced that the larvæ were guided by this means into safety, exactly as chickens are by the clucking of their mother. As they are without trace of eyes, it is difficult to resist this conclusion."

Dr. Ohaus speaks above of the parent beetles triturating the wood for their offspring; the mandibles with which they do this are strong, and are provided with a molar tooth at the base and another movable tooth just above this. The action of this tooth has been observed by Zimmermann and others; it is placed close to the stationary tooth, which forms its fulcrum, and this arrangement helps the insect in the division of the wood into minute fragments. The muscles of the movable tooth appear to be situated in the substance of the mandibles (*v.* Lacordaire, Gen. Coléopt. iii, pp. 44, 45).

In the **Passalidæ** the males and females are identical externally, differing entirely in this respect from the **Lucanidæ**.

Family 101. LUCANIDÆ.

Convex or moderately convex, but not cylindrical, insects; antennæ with a pectinate club, the joints of which cannot be applied to one another, elbowed or geniculate; labrum nearly always connate with the clypeus; mentum entire; mandibles very strongly developed in the males; maxillæ with two lobes; anterior coxal cavities closed behind; intermediate coxæ transverse; mesosternum short, metasternum large; elytra not longitudinally sulcate, entirely covering abdomen; tarsi five-jointed, the last joint elongate.

The **Lucanidæ**, or Stag-Beetles, are among the best known of the Coleoptera by reason of the great development of the mandibles in the males, these being usually regarded as horns by the ordinary observer. In some of the exotic species these organs are nearly as long as the rest of the body; they are not, however, very powerful, and their use is not quite apparent; the female of the common British Stag-Beetle (*Lucanus cervus*, L.) for instance can, with two very short pincer-like nippers, give a much more severe bite than the male with his enormous mandibles, and we cannot discover any definite purpose, offensive, defensive, or economic, for the development of the latter.

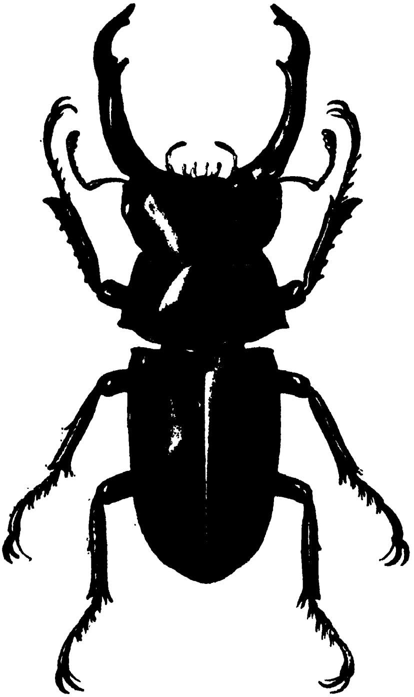


Fig. 93.—*Hemisodorcus nepalensis* (natural size).

The larvæ are large fleshy maggots, and the segments are not raised in three folds as is the case with the majority of the SCARABÆIDÆ; the antennæ are short and the legs moderate. They feed in wood and apparently take some years to come to maturity.

About 600 species have been described; a considerable number are found in the Indo-Malayan region, and the Indian region is fairly rich both in genera and species, nearly half the species of *Lucanus* being found there.

[Family 102. SINODENDRIDÆ.]

Small, or comparatively small, completely cylindrical insects; antennæ rather short and stout, with a pectinate club, not elbowed or geniculate ; mandibles short in both sexes and concealed by the head (if viewed from above) ; ligula not concealed by the mentum ; male with a long horn on the front ; anterior part of thorax suddenly cut off at an angle of about 80° ; prosternum very narrow ; legs short and robust, the femora not or hardly visible beyond the elytra ; elytra completely covering the abdomen ; all the coxæ contiguous.

Although only a few species (confined to Europe and North America) are known as belonging to this family, yet they are so very different from the Lucanidæ that they can hardly be retained under them. Dr. Sharp (Cambridge Natural History, vi, p. 194), after alluding to the Ceratognathinæ of Australia and New Zealand as a remarkable and aberrant group, having the structure of the antennæ like that of the Scarabæidæ rather than of the Lucanidæ, proceeds to speak of the Sinodendridæ as the most aberrant group of all. The cylindrical form, the curious formation of the front of the prothorax, and the sexual characters, which are rather those of the Dynastinæ, together with the Lucanid pectinate antennæ, seem to be quite sufficient to separate them. The larvæ, moreover, are different, being more slender and gradually narrowed behind. They are found in all stages in rotten stumps, etc.

Family 103. SCARABÆIDÆ.

More or less convex insects, varying enormously in size, and chiefly distinguished by having the lamellæ of the antennæ movable and capable of being brought close together or separated; antennæ seven- to eleven-jointed (usually ten-jointed), club three- to seven-jointed (usually three-jointed), variable in form, first joint elongate : anterior coxal cavities large, transverse, closed behind, pygidium usually exposed ; abdomen, as a rule, with six, or (at the sides) seven visible ventral segments ; legs fossorial, but variable ; tarsi five-jointed, the anterior pair sometimes absent.

The arrangement of the Scarabæidæ has been much disputed. Erichson (1847) divided the whole of the Lamellicornia into two sections, which depend upon the situation of the abdominal spiracles—the "Scarabæides Laparosticti" and the "Scarabæides Pleurosticti"; under the latter he includes the Lucanidæ and Passalidæ. Lacordaire (1856) adopted these two divisions for the Scarabæidæ, but placed the Lucanidæ and Passalidæ in a separate group, Pectinicornia. Ganglbauer (1903) has apparently gone back to Erichson's system and regards the LAMELLICORNIA and SCARABÆIDÆ as synonymous. Leconte and Horn (Classif. Col. North America, 1883, p. 248), observing that the MELOLONTHIDÆ and their allies were intermediate between the Laparosticti and the Pleurosticti, added a third division MELOLONTHIDÆ.

Both Erichson's and Leconte and Horn's divisions are unsatisfactory, for, as Arrow has pointed out (Trans. Ent. Soc. Lond. 1909, p. 480), the division of the SCARABÆIDÆ into LAPAROSTICTI and PLEUROSTICTI according to the situation of the spiracles does not correspond with any sharp natural line of cleavage, as there are not only two but several types which pass one into the other, and the point of division must necessarily be arbitrary. Recently, too, Dr. Ohaus (Deutsche Ent. Zeitschr. 1909, p. 427) has pointed out that *Aclopus brunneus* is Laparostict in the male and Pleurostict in the female. At the same time Arrow allows that the distinction is useful, and gives the following table for the Laparostict SCARABÆIDÆ, that is to say, those subfamilies in which the posterior spiracles are situated in the membrane between the dorsal and ventral plates of the segment:—

I. Antennal club of more than three joints.	
i. Antennæ eleven-jointed	PLEOCOMINÆ.
ii. Antennæ eight-jointed	PACHYPODINÆ.
II. Antennal club composed of three joints.	
i. Labrum and mandibles horizontally extended, flattened.	
1. Eyes divided in front.	
A. Labrum as long as mandibles	ACLOPINÆ.
B. Labrum shorter than mandibles.	
a. Antennæ eleven-jointed	GEOTRUPINÆ.
b. Antennæ ten-jointed.	
*a**. Antennal club telescopic, joints cup-shaped.................	HYBOSORINÆ.
*b**. Antennal club simple, lamellate.	
a†. Stridulating plate in hind coxal cavity	TAUROCERASTINÆ.
b†. Stridulating plate on hind coxa.	ORPHNINÆ.
b. Antennæ nine-jointed	CHIRONINÆ.
2. Eyes entire	OCHODÆINÆ.
ii. Labrum and mandibles not horizontally extended.	
1. Antennæ ten-jointed.	
A. Labrum very small	IDIOSTOMINÆ.
B. Labrum large	TROGINÆ.
2. Antennæ eight- or nine-jointed; labrum reduced and concealed.	
A. Hind tibia two-spined; mid-coxæ contiguous	APHODIINÆ.
B. Hind tibia one-spined; mid-coxæ separate	COPRINÆ.

All the above subfamilies, with the exception of the PLEOCOMINÆ, PACHYPODINÆ, ACLOPINÆ, TAUROCERASTINÆ, and IDIOstominæ, occur in the Indian region. Some of them are very small; the Idiostominæ, for instance, contain only one genus, and the Aclopinæ two genera. Taken as a whole they correspond to the Coprinæ of Sharp and other authors, and comprise a large number of species which vary very largely in size, from the small species of *Aphodius*, *Trox*, *Ægialia*, etc., to the large *Heliocopris* and *Scarabæus*. They live chiefly on dung or in and under dead animals; the majority prefer animal matter in a moist state, while others, such as *Trox*, are found among bones, skins, etc. In some of the species which bury masses of dung for the food of their larvæ, the mother survives and sees the growth of her young to the perfect state, and then produces another generation (*v.* Sharp, *l. c.* p. 197). This is another proof of the high position attained by the Lamellicornia. The group as a whole is largely represented in India. Between the Laparostict and Pleurostict Scarabæidæ come the Melolonthinæ, Glaphyrinæ, and Oncerinæ; these differ very much *inter se*, and Leconte and Horn found it necessary to place the first tribe under the heading of Pleurostict Melolonthinæ, and the last two under the heading of Laparostict Melolonthinæ. We need not here discuss the question, as

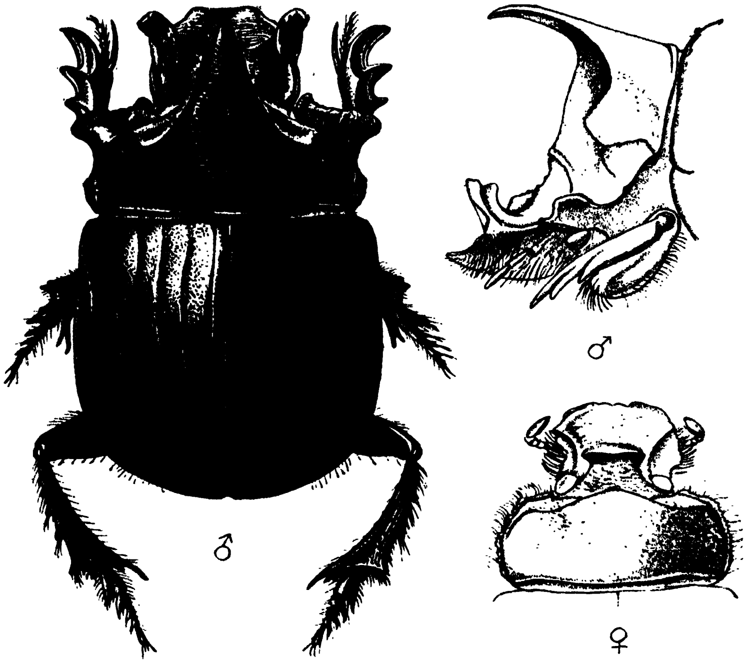


Fig. 94.—*Heliocopris bucephalus* (natural size).

neither the Glaphyrinæ nor the Oncerinæ occur in India; it is, however, worthy of notice that the Glaphyrinæ, contrary to all rule, have a spiracle on the pygidium, a character which isolates them from all the other groups.

Several of the European genera of the Melolonthinæ (e. g. *Hoplia*, *Serica*, *Melolontha*, and *Rhizotrogus*), as well as others, are represented in the Indian region.

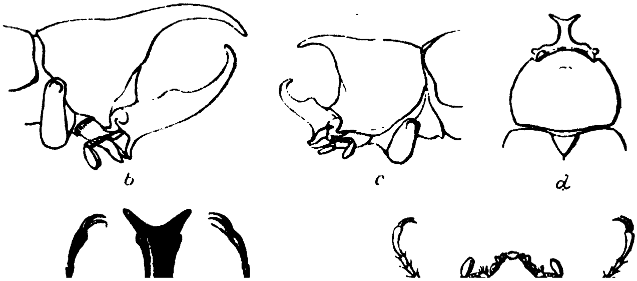
As a rule the sexual differences in the Melolonthinæ are not very striking; the lamellæ of the club, however, are in some instances more developed in the males than in the females, and in certain genera the legs are enormously developed in the male. Mr. Arrow, in the table given in his recent work (*l. c.* p. 22), includes the Melolonthinæ under the Pleurosticti as follows:—

Posterior spiracles situated in the dorsal part of the chitinous ventral segments..................	Pleurosticti.
i. Labrum membranous, not exposed.	
1. Mandibles not visible externally; front coxæ vertical..............................	Cetoniinæ.
2. Mandibles partly visible externally; front coxæ transverse	Dynastinæ.
ii. Labrum chitinous and visible externally.	
Posterior spiracles placed in strongly diverging lines; claws movable, unequal	Rutelinæ.
Posterior spiracles placed in scarcely diverging lines; claws generally fixed and equal ..	Melolonthinæ.

The Rutelinæ vary very much in size and appearance; the large forms are almost entirely tropical, and are, in many cases, amongst the most conspicuous and beautiful of the Coleoptera; the smaller forms (*Adoretus*, *Phyllopertha*, etc.) are not very noticeable. They are to a great extent distinguished from the allied subfamilies by having the tarsal claws unequal. This, however, is a somewhat variable character; in some of the species it is well marked, but in others the difference is not very striking. The stridulating organs of the group are very interesting, but at present no Indian Rutelinæ are known to possess any. Lacordaire and others have commented on the remarkable geographical distribution of the subfamily. All the very conspicuous species appear to occur in America and Australia; the *Anomala* group is widely, but unevenly distributed, while *Adoretus* and its allies are peculiar to Africa, Madagascar and Asia. About a dozen Indian genera have been recorded. The species of *Adoretus*, of which a very large number occur in the Indian region, are moderate-sized, more or less elongate and depressed insects, of blackish, brown, and yellowish colours, and clothed with fine greyish pubescence. *Anomala* and its allies, *Singhala*, *Mimela*, *Popilia*, etc., are also well represented in the region.

The members of the subfamily Dynastinæ are closely allied to the Rutelinæ, from which they are distinguished by the equal claws of the tarsi, and also by having the labrum (which is, almost without exception, visible in the last-mentioned family) concealed beneath the clypeus, the margin only being visible in certain cases.

The subfamily is remarkable for the size of many of its members, some of which are amongst the largest of the Coleoptera, and also for the extraordinary horns and prominences on the head and prothorax of many of the males. *Dynastes hercules* reaches 160 mm. (almost six inches) in length, and the species of *Megasoma* are even more massive than this.



by their extreme variability in the same species, and by their extensive diversity in closely allied species"—is that they have "been acquired as ornaments. This view will at first appear extremely improbable, but we shall hereafter find with many animals standing much higher in the scale, namely, fishes, amphibians, reptiles, and birds, that various kinds of crests, knobs, horns, and combs have been developed apparently for the same purpose."

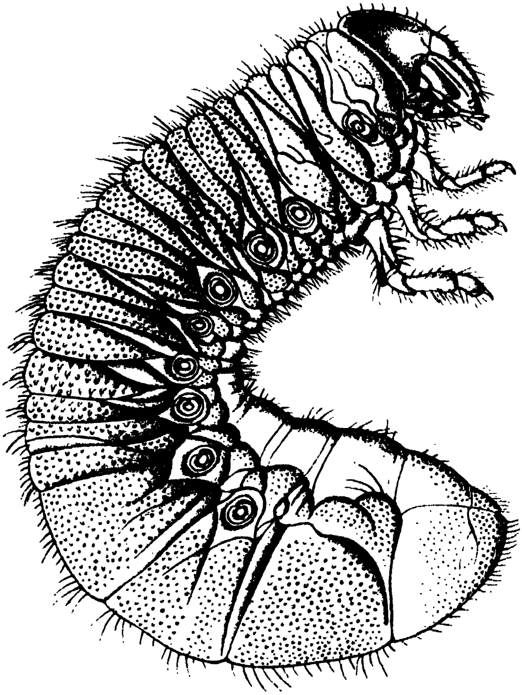


Fig. 96.—*Xylotrupes gideon.* Larva × ⅔. (After Schiödte.)

We very much doubt this theory, and it is possible that there may be no explanation further than the fact that these growths are the outcome of a cell-stimulus of which at present we know nothing.

These gigantic species, in spite of their formidable appearance, are quite harmless. They are mostly nocturnal or crepuscular in their habits, and live in the hollows of old trees, feeding on exuding sap. Their colouring, therefore, is mostly of a sombre description, black or brown; one fine Indian species, *Chalcosoma atlas*, is plainly, but not strongly, metallic.

The larvæ of the Dynastinæ appear to be intermediate between those of the Melolonthinæ and the Cetoniinæ. That of *Xylotrupes gideon*, L., is figured and described by Schiödte (Nat. Tidsskr. ix, p. 287, pl. viii), who also gives details of the larva of *Oryctes nasicornis*, L. (p. 290, pl. x). They are typical Lamellicorn larvæ, and, as in the Melolonthinæ, they have the transverse furrows of the segments well marked and the same formation of the anal segment and opening. They resemble the Cetoniid larvæ in having the general form shorter, the head narrower than the body, and the mandibles toothed and furnished on their upper surface with a transversely striated area; the upper surface is covered with short spines, and is more or less hairy.

Several important genera are represented in the Indian region, among them *Heteronychus*, *Dipelicus*, *Trichogomphus*, *Eupatorus*, *Xylotrupes*, and *Chalcosoma*. *Eupatorus* contains two or three fine species which are peculiar to that region.

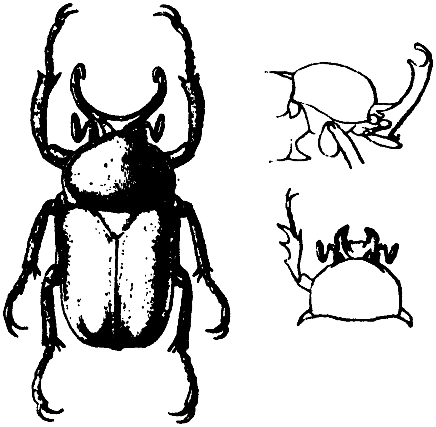


Fig. 97.—*Cyphonocephalus olivaceus*, male, with lateral view of head and thorax (above), and fore-part of female (below).

The members of the subfamily Cetoniinæ are remarkable for their beauty, a point in which they run the Rutelinæ very close, although, like the latter group, they possess many inconspicuous as well as large and conspicuous forms. The huge Goliath beetles of Africa are worthy of being classed with *Megasoma*, etc., as the largest of the Coleoptera, and the size varies down to quite small insects (*Oxytherea*, etc.). In many of the genera there is no sexual dimorphism, but in some, e. g. *Cyphonocephalus*, it is very marked, the head (and sometimes the prothorax) of the males being armed with horns or excrescences. The species vary much in appearance, the hairy *Trichii* looking like large bees as they fly, and appearing perfectly distinct, at first sight, from the ordinary Cetoniid forms. There seems to be a strong relation between certain species and ants; the common, but very beautiful, Palæarctic species, *Cetonia aurata*, is often found in ants' nests, and members of the large group CREMASTOCHILINI are supposed, by several authors, to be retained in ants' nests as inquilines by their hosts. Mr. Guy Marshall, however, informs me that this is certainly not so in every case, as he has seen ants ejecting many examples of an African species from their nests.

The larvæ of the CETONIINÆ are remarkable for having the tenth ventral segment merged in the ninth, with or without dividing furrows; the segments as a whole are less deeply furrowed transversely than is usual in the SCARABÆIDÆ, and the upper surface is more hairy. They approach the larvæ of the DYNASTINÆ and recede from those of the MELOLONTHINÆ in having the mandibles toothed at the apex and in their hairy surface, but otherwise much resemble the latter.

The CETONIINÆ, as might be expected from their generally brilliant colours and appearance, differ in their habits from the DYNASTINÆ in being, with a few exceptions, diurnal and not crepuscular or nocturnal. Mr. Arrow says of the group that it may be regarded as one "of comparatively late evolution, and as still enjoying the maximum of vigour and prosperity." Very little is known of the life-history of its members.

The CETONIINÆ are well represented in the Indian region, which contains some of the most beautiful forms. In America, which is rich in striking RUTELINÆ, the larger and more brilliant CETONIINÆ are very few in number. The curious group VALGINÆ, of which many species are found in India, seems to be distributed over the greater part of the world. Several authorities consider the CETONIINÆ to be at the head of the SCARABÆIDÆ, and therefore as the culminating point of the Coleoptera *. Whether we allow this or not it seems most probable that the SCARABÆIDÆ are at the head of the order, and we need not differentiate further.

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* Thus Ganglbauer says, "Die prächtigen Cetonien stehen daher auf der höchsten stufe der Scarabæiden und der Co'eopteren überhaupt' (Münch. Kol. Zeitsch. i. 3, p. 314).

ABNORMAL COLEOPTERA.

STREPSIPTERA or STYLOPIDÆ.

Minute species parasitic in the interior of Hymenopterous or Hemipterous insects; prothorax reduced to a narrow band; elytra aborted, reduced to small, more or less twisted, slips; metathorax very large; wings of male very large, longitudinally folded when at rest; tarsi two- three- or four-jointed, without claws; male free, metagnathous (i. e. *with the mouth adapted for sucking in the imago and for biting in the larva*); *female blind, larviform, and never quitting its host.*

Probably many more genera and species of these remarkable insects exist than have been yet discovered. They have been found in Europe, North America, Brazil, Africa and Mauritius, and stylopized bees have been observed in Tasmania and other countries; most probably they are represented in the Indian region.

They are parasitic on various Hymenoptera and Hemiptera, and their life-history, so far as at present known, is very strange. The female is a wingless grub which never quits its host. According to the generally received accounts given by authorities who have studied the insects, the female possesses a dorsal canal by which the male effects impregnation; the larvæ, which are active and campodeiform triungulins (as in *Meloë*), escape by this, the ova being developed and hatched in the cœlom or body-cavity. The STREPSIPTERA or STYLOPIDÆ are therefore remarkable as being viviparous; this character, however, is found in many other insects, *e. g.* the ANTHOMYIDÆ, various MUSCIDÆ and PUPIPARA among the Diptera, certain Tineid moths, the APHIDÆ, some BLATTIDÆ, and a few STAPHYLINIDÆ among the Coleoptera. There appears, however, to be some doubt with regard to the accuracy of the above observations, more especially as regards the dorsal canal of the female, and they must not be accepted without considerable reservation.

Very little, if anything, is known about the way in which the young triungulins reach the larvæ of the insects on which they are parasitic; but when this is accomplished they bore into their host and are transformed into legless and sluggish vermiform larvæ. subsequently pupating in the same situation. The male, when it emerges, is free and very active, but the female remains within the host, only the head protruding. According to Meinert (Ent. Meddel. v, 1896, p. 148, and Overs. Danske Selsk. 1896, p. 67, quoted by Sharp, *l. c.* ii, p. 302) the so-called head or cephalothorax of the adult is the anal extremity, and he contends that fertilization and the escape of the young are effected by the natural passages, the anterior parts of the body being affected by a complete degeneration. Sharp is inclined to agree with Meinert rather than with Nassonoff, who says that the "cephalothorax" of the young is shown by the nervous system to be the anterior extremity. The whole question is as yet a very obscure one. The males of these perfect insects are very short-lived, the life of the male of *Xenos* lasting for about twenty minutes, while that of *Stylops* may be continued for two, or at most three, days.

The position of the group is very uncertain. If its members are to be regarded as Coleoptera they must certainly be placed at the end of the Order as abnormal, but there is very strong ground for separating them off as an Order by themselves, as proposed long ago by Westwood, whose view has been followed by Von Siebold and recently by Nassonoff. It must be allowed that they have several points in common with the Coleopterous genus *Meloë*, but, as regards the mouth-organs, they have been compared with the Diptera and Lepidoptera. Westwood ('Modern Classification of Insects,' ii, p. 290) regards the mouth-organs as analogous to those of certain Lepidoptera, and, after referring to Newman's belief that the STYLOPIDÆ are closely allied to the Diptera, proceeds as follows:—"I cannot, however, find the least analogy between the oral organization of the Strepsiptera and the tubularly developed elbowed mouth of the Diptera, the labrum of which is greatly elongated: whereas, on the contrary, there seems to me much greater resemblance, in this respect, between the Strepsiptera and Lepidoptera, the labrum in both being soldered flatly to the head, the acute mandibles, as they have been termed in *Stylops*, being exactly represented, in some of the Linnæan Bombyces, by the short rudimental maxillæ, and the large articulated appendages being much more analogous to the labial palpi of the Lepidoptera than to the maxillary palpi of the Diptera."

Taking all points into consideration, it is very doubtful whether we can regard the STYLOPIDÆ as belonging to any existing order, in which case they are best regarded as separate under the old name Strepsiptera.

PART II.

CICINDELIDÆ.

THE CICINDELIDÆ, or Tiger Beetles, as they are commonly called, on account of their activity and ferocity, are very closely allied to the CARABIDÆ, of which they are considered by some authors to be a subfamily; they appear, however, to be distinct, both from their life-history and from their structure. The clypeus extends laterally on both sides in front of the insertion of the antennæ, whereas in the CARABIDÆ it does not reach as far as the points at which they are inserted (fig. 98). The ligula and paraglossæ are only slightly developed, and in nearly all cases the large inner lobe of the maxilla is terminated by a sharp articulated hook: the latter character, however, can hardly be regarded as distinctive, as the moveable hook is entirely wanting in the Cicindelid genera *Ctenostoma* and *Pogonostoma*, while it is present in the Carabid genus *Trigonodactyla*. The curious formation of the appendages of the last abdominal segments in the female, to which sufficient attention has hardly yet been paid by writers, may be regarded as a distinctive character, and the wing venation is also different, the areola oblonga, which is so characteristic of most of the Carabidæ, being absent.

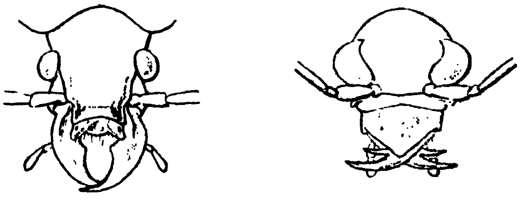

Fig. 98.—Head of *Cicindela* (right), *Carabus* (left).

The general characteristics of the family are as follows:—

Head large; eyes prominent or very prominent; maxillæ with the outer lobe forming a two-jointed palpus (except in the genus *Therates*, in which it is rudimentary and resembles a stout seta) and the inner lobe elongate and furnished at the end with an articulated hook-like process (except in the genera *Pogonostoma* and *Ctenostoma*); antennæ 11-jointed, filiform, or occasionally somewhat incrassate towards the apex, inserted on the forehead above the base of the mandibles; clypeus extending laterally in front of the insertion of the antennæ; elytra covering, or nearly covering, the abdomen; wings usually large and powerful, but absent in some cases; abdomen with the three anterior segments connate, with six ventral segments visible in the female, and seven, as a rule, in the male; legs slender, long or very long, adapted for running swiftly; posterior coxæ dilated internally, not reaching the sides of the body; all the tarsi five-jointed.

Comparatively little is known of the life-history of the members of the family, and we are quite ignorant of the development of any species of certain of the most important genera, e. g. *Tricondyla* and *Therates*. The chief points that have been ascertained with regard to *Cicindela* and *Collyris* will be found referred to under these genera.

The family comprises about 1200 species, just half of which belong to the genus *Cicindela*; the latter genus is spread throughout the world, but most of the other genera are confined to tropical or subtropical countries.

The CICINDELIDÆ afford excellent examples of protective resemblance and mimicry. In the genus *Cicindela* we find chiefly protective resemblance, but in the case of *Collyris* and *Tricondyla* we have excellent instances of true mimicry. In some cases species of these genera serve as models for insects belonging to quite another order. One of the strangest of these is found in *Condylodera tricondyloides*, Westw. This curious Locustid was originally described by Professor Westwood from Java (Trans. Linn. Soc. Lond., Zool. xviii, p. 409), and was first placed by him among the CICINDELIDÆ, as he regarded it "as an immature *Colliuris* or *Tricondyla*" (*l. c.* p. 419). Another Javanese specimen was actually named *Tricondyla rufipes* by Duponchel.

Mr. R. Shelford has fully discussed the case of this insect with others (Proc. Zool. Soc. Lond. 1902, vol. ii, pp. 230-282), and gives excellent figures. His first two specimens were fully grown and exactly resembled in shape, colour, environment, and even gait *T. cyanea* var. *wallacei*. A third was found in the Sarawak Museum, smaller, and imitating *Tricondyla gibba*; a fourth was taken at Kuching in the flowers of a flowering tree frequented by *Collyris sarawakensis*: this was smaller and imitated *C. sarawakensis* in every way. The insect at this younger stage is entirely dark blue, except the legs, which are dark brown, and the greater part of the antennæ, which are ochreous, the four basal joints only being blue; the pronotum shows no trace of the coloration of the adult, nor is it swollen as in the later stages, but is more or less cylindrical like that of the model, in which it is comparatively longer and more cylindrical than in almost any other species of the genus. This, as Mr. Shelford points out, is a unique case of an ametabolous insect mimicking different genera and species of metabolous insects at different stages; although *Hymenopus bicornis*, a well-known Mantid, which imitates flowers through most of its life, in its early stages mimics an Hemipteron.

Mr. Herbert C. Robinson has given an interesting account (Fasciculi Malayenses, Zoology, Part i, October 1903) of the Tiger Beetles met with by Dr. Nelson Annandale and himself during their expedition in the Malay region. As the work is expensive and apparently difficult to obtain we quote at length the remarks on *Collyris sarawakensis*, which have a strong bearing upon Mr. Shelford's observations:—

"This species and the preceding (*Collyris apicalis*, Chaud.), which it closely resembles, were not uncommon on Bukit Besar. They frequented fairly open paths where there was much alternation of light and shade, and were extremely active and restless in their movements, settling for a few seconds on some projecting twig or leaf, and then flying off with great rapidity. While on the wing they could with difficulty be distinguished from the smaller wasps of the family Scoliidæ, and from certain Diptera (Sciomyzidæ ?), but this resemblance quite vanished when the beetles were at rest. Perhaps, however, the most interesting member of this mimetic association is a Heteromerous beetle, originally described by Westwood as *Styrax tricondyloides*, and which appears to be exceedingly rare, as there is only a single specimen in the Bates collection at the British Museum. The single specimen that we captured, which we did not specially note at the time, was secured on Bukit Besar in the sweep-net on April 20th, and, so close was its resemblance to the three preceding species, that it was actually taken home to the British Museum with the Cicindelids, and only recognised there on a rigid examination as not belonging to this family. Both it and its model have red legs and cyaneous elytra, which are strongly rugose at their anterior halves, while the posterior portion is smooth and shining, though, in the case of *S. tricondyloides*, it is slightly striated. The thorax of the mimic has two large tubercles on the disc, projecting slightly forward as a kind of hump, with the result that the thorax appears to be slightly constricted anteriorly, as is the case in the species of *Collyris*.

"It is not at first sight easy to understand why this section of the Cicindelids should be so extensively mimicked, as they certainly are, in the Eastern tropics (*cf.* R. Shelford, Proc. Zool. Soc. 1902 (2), pp. 233–4, pl. xix, figs. 1–6). They are, of course, highly raptorial insects, but I am not aware that it has ever been shown that they are nauseous, while, even if this was the case, they are not, at any rate, in the Malay Peninsula, sufficiently abundant for any protective qualities that they may possess to prove any advantage to their mimics.

"Possibly all cases in this group may ultimately be shown to be instances of Müllerian rather than Batesian mimicry, though the extreme rarity of the mimic is an argument against this supposition."

The family falls naturally into two groups, which are named by Dr. Horn Alocosternaliæ and Platysternaliæ. In the former of these the episterna of the metasternum are reduced to a longer or shorter narrow band, which is more or less strongly sulcate, while in the latter they are broad and smooth. Taking the Indian fauna only into consideration, the former division contains the genera *Collyris*, *Neocollyris*, *Derocrania*, and *Tricondyla*, while the genera *Therates*, *Cicindela* and *Megacephala* must be referred to the latter. These represent four subfamilies, the COLLYRINÆ, THERATINÆ, CICINDELINÆ and MEGACEPHALINÆ. By some authors *Therates*, the only genus belonging to the THERATINÆ, is included under the COLLYRINÆ, to which it is related in certain points, especially in the armature of the last segment of the abdomen,

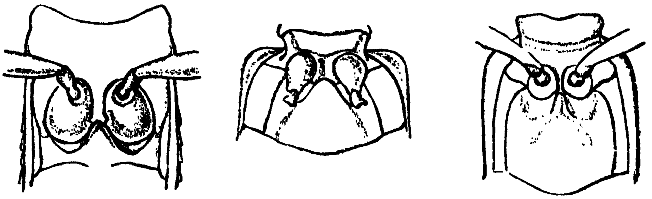

Fig. 99.—Metasterna (left to right) of *Tricondyla*, *Cicindela*, and *Collyris*.

which much resembles that of *Neocollyris*. Its affinities, however, are much more towards the CICINDELINÆ, and it is abundantly separated from the COLLYRINÆ by the broad and smooth episterna of the metasternum. The subfamilies may be distinguished as follows:—

I. Episterna of the metasternum very narrow, more or less strongly furrowed (ALOCOSTERNALIÆ) .... **Collyrinæ**, p. 223.
II. Episterna of the metasternum broad and smooth (PLATYSTERNALIÆ).
  1. Outer lobe of the maxillary palpi obsolete, represented by a short seta-like process. **Theratinæ**, p. 293.
  2. Outer lobe of the maxillary palpi normal and well developed.
    A. Third joint of the maxillary palpi shorter than the fourth .... **Cicindelinæ**, p. 300.
    B. Third joint of the maxillary palpi longer than the fourth .... **Megacephalinæ**, [p. 441.

Division *ALOCOSTERNALIÆ*.

Alocosternaliæ, W. Horn, Berlin. Ent. Zeit. 1905, ii, p. 5.

Besides the COLLYRINÆ this division includes the CTENOSTOMINÆ. The latter subfamily, which consists of two genera, is not represented in the Indian region, the genus *Pogonostoma*, Klug, being confined to Madagascar, while the genus *Ctenostoma* belongs exclusively to Central and South America; they are distinguished from the COLLYRINÆ, as above-mentioned, by the absence of a hook at the apex of the inner lobe of the maxillary palpi.

Subfamily COLLYRINÆ.

Four genera are contained in this subfamily; of these the species belonging to *Collyris* and *Neocollyris* have usually been classed together. The following table will serve to distinguish them:—

I. Labrum with seven teeth; wings always present; female with two small and usually sharp projections on the posterior edge of the last ventral segment of the abdomen.
  i. Head very widely, deeply, and roundly excavate between the eyes; vertex behind the eyes very short; size larger .... COLLYRIS, F., p. 223.
  ii. Head narrowly impressed between the eyes, bistriate, vertex behind the eyes more or less long; size smaller .... NEOCOLLYRIS, W. Horn, [p. 229.
II. Labrum with six teeth; wings absent; elytra connate; female without the two central projections on the last ventral segment of the abdomen.
  i. Frontal excavation always very deep; vertex as a rule not or scarcely strangulate behind .... TRICONDYLA, Latr., p. 273.
  ii. Frontal excavation often wanting, or not very deep; vertex always strongly strangulate behind ...... DEROCRANIA, Chaud., [p. 282.

Genus COLLYRIS.

Collyris, Fabricius (*ex parte*), Syst. El. i, 1801, p. 226.
Colliurus, Latreille (*ex parte*), Gen. Crust. Ins. i, 1806, p. 174.
Archicollyris, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 43.

Type, *Collyris longicollis*, Fabr.

Chaudoir divides the species of *Collyris* into two groups, *Collyrides ingenuæ* and *Collyrides spuriæ*; these are very easily distinguished from one another by the shape of the head which, in the first group, has the vertex behind the eyes very short, and the space between them deeply excavate, the excavation being more or less carinate behind; whereas, in the second group, the vertex behind the eyes (or, as it is sometimes called, the occiput) is long, more or less convex or pulvinate, and the space between the eyes is much more narrowly and less strongly impressed.

The full characters of the groups, as given by Chaudoir, are as follows:—

Collyrides ingenuæ, Chaudoir, Ann. Soc. Ent. France, 1864, p. 489.

Labrum with the external teeth separated from the intermediate by a narrow and very deep fissure, very sharp; maxillary palpi with the third joint rather long in both sexes, strongly clavate, the last very short, smaller, subglobose or securiform in the male, narrower in the female; head with the forehead between the eyes very widely, deeply, and roundly excavate, with the posterior margin of the excavation semicircular, subcarinate, vertex (behind eyes) very short.

Collyrides spuriæ, Chaudoir, *op. cit.* p. 493.

Labrum with the central teeth obtuse, and the external tooth on each side separated from the rest, sharp; maxillary palpi with the third joint a little shorter than the last, the latter sub-elongate, ovate; labial palpi with the last joint securiform, more dilated in the males. Head with the forehead between the eyes narrowly impressed, bistriate, the vertex broadly pulvinate or cushion-shaped, and not sloping abruptly downwards.

The characters, however, of the teeth of the labrum or of the palpi are not of much value, as they are very variable in different species, and Dr. Horn, who raises these groups into subgenera (*Archicollyris* and *Neocollyris*) omits them in his description and rightly lays special stress on the large size of the species of the first subgenus, and on the difference in the shape of the vertex and front. In these latter points there are no intermediate forms, and, as they appear certainly to be distinct genera, and *Collyris longicollis*, is the original type of the genus, the name *Collyris* must stand for the species contained in Dr. Horn's *Archicollyris*, and *Neocollyris*, Horn, may be adopted for the rest of the genus.

The genus, as now constituted, contains four species, all of which occur in India: they may be roughly separated as follows, but are very hard to distinguish in two or three cases:—

I. Elytra sometimes rugose, but not distinctly plicate in the centre.	
i. Pronotum strongly constricted at base	*longicollis*, F., p. 225.
ii. Pronotum not strongly constricted at base.	
1. Shoulders oblique.	
A. Elytra longer, less regularly punctured...............	*dohrni*, Chaud., p. 225.
B. Elytra shorter, more regularly punctured................	*brevipennis*, W. Horn, p. 226.
2. Shoulders rectangular	*brevipennis* var. *subtilesculpta*, [W. Horn, p. 226.
II. Elytra, as a rule, with strong plicæ in the centre *	*mniszechi*, Chaud., p. 227.

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* In some cases these are absent, and the species may then be distinguished by the more ovate and dilated central portion of the pronotum, and other minor characters.

1. Collyris longicollis, *F.*

Collyris longicollis, Fabricius, Mant. Ins. 1787, p. 185; Syst. El. 1801, p. 226; Herbst, Käf. x, 1806, p. 215, pl. 173, fig. 9; Chaudoir, Ann. Soc. Ent. France, 1864, p. 690, pl. 7, f. 1.
Collyris caviceps, Klug, Jahrb. Insektenk. i, 1834, p. 45; Chaudoir (*ex parte*), Ann. Soc. Ent. France, 1864, p. 491.

Colour variable, bright cyaneous blue or purple or blackish; labrum black or yellow; antennæ reaching to about the middle of the pronotum, only slightly thickened towards apex, varying in colour, palpi dark or rufescent; pronotum elongate, longer than the head and labrum together, with a strong contraction just before base, which is sinuate, inflated in front of the contraction and gradually narrowed to the pronotal collum, which is somewhat abrupt, inflated portion more rounded in some specimens than in others, collum short, reflexed anteriorly, disc with fine transverse wrinkles; elytra twice as broad as pronotum, with the humeral angles blunt but well-marked, subparallel-sided, strongly punctured towards the base, the punctures becoming somewhat rugose but not plicate about middle, and being smaller and more closely set behind; legs rufous, with the tibiæ, tarsi, and coxæ dark; episterna of metasternum finely punctured; abdomen almost smooth, the apical portion more or less rufescent.

Length 18–27 millim.

The following localities have been given for this species:—MADRAS: Mysore (?); BENGAL: Chota Nagpur, Sahibganj; SIKKIM: Mungphu; ASSAM; SIAM; but Dr. Horn is of opinion that the species is known only from Bengal (Annotated List of the Asiatic Beetles in the Indian Museum, Part i, p. 2); the other localities must therefore, apparently, be referred to allied species.

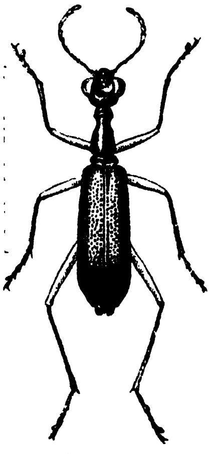

Fig. 100. *Collyris longicollis.*

Dr. Horn (D. E. Z. 1898, p. 273) believes that *C. caviceps,* Klug, is the male of *C. longicollis,* but he says that he has not seen a trustworthy specimen of the male of the latter species.

2. Collyris dohrni, *Chaud.*

Collyris dohrni, Chaudoir, Bull. Soc. Moscou, 1860, ii, p. 286; id. Ann. Soc. Ent. France, 1864, p. 490.

This species is a little larger than the average specimens of *C. longicollis* and also differs from them in the black, somewhat opaque colour, and the unspotted palpi and antennæ, the latter having the first six joints dark blue; the pronotum is more elongate, less deeply constricted before the base, with the intermediate portion exactly conical, not abruptly narrowed in front, the upper surface thickly and plainly striate; elytra with the shoulders more oblique, more strongly punctured at the apex, and with the interstices very finely reticulate; femora obscurely red.

Length 26½ millim.

CEYLON: Colombo.

This species has, apparently, occurred only in Ceylon. There is a large specimen in the Oxford Museum, unnamed, labelled as from Assam, which agrees in several points very closely with Chaudoir's description, especially in the shape of the pronotum. I have provisionally referred it to *C. longicollis* var. *caviceps*, Klug, but it may possibly belong to this species. It is a large dark coloured female, in bad condition, almost 28 millim. in length. Chaudoir mentions a specimen in the Hope collection, "en assez mauvais état," as belonging to *C. caviceps*, but speaks of it as from Mysore; it is possible, however, that this is the specimen he refers to, as the writing on the label is not distinct.

3. Collyris brevipennis, *W. Horn.*

Collyris brevipennis, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 44.
Var. *Collyris subtilesculpta*, W. Horn, l. c.; Maindron, Ann. Soc. Ent. France, 1905, p. 6.

Of a violaceous colour, with the labrum cyaneous, and with an æneous reflection on the elytra. Head very strongly excavate, with the part between the furrows small and convex; pronotum long, not strongly constricted at base, with the pronotal collum not abruptly marked, upper surface strongly strigose transversely, underside pilose and finely strigose; elytra closely, strongly, and regularly punctured to the apex, the interstices being well marked; towards the apex the punctures form deep linear impressions; metasternum finely but evidently punctured; femora and apex of posterior tarsi red, the rest of the legs dark.

From *C. longicollis* this species differs in having the pronotum less narrowed in front and less dilated behind, much less strangulate before the base, and more thickly strigose transversely: the elytra are much shorter and more regularly reticulate, especially in the middle.

Length 24 millim.

BOMBAY.

Type in coll. W. Horn.

Var. subtilesculpta, *W. Horn.*

Larger than the type form; of a steely blue or violaceous colour; the vertex is not quite so deeply excavate between the eyes; the pronotum is a very little more constricted near the apex and the basal sulcus is rather broader and more evident at the sides; the elytra are larger, wider, and more ampliated, with the shoulders more marked; the punctuation is of much the same character, but with the interstices less raised, so that the punctures appear to be less deep, and the surface less reticulate; before the apex, also, the punctures are less markedly elongate; the legs appear to be proportionally longer, but this is not very evident; the underside of the pronotum is sparsely punctured, and the metasternum is more distinctly punctured than in the type form.

From *C. dohrni* this variety may be known by having the vertex a little less declivous, and by the more rectangular shoulders of the elytra, which are over their whole surface more finely and thickly and less deeply punctured, with the interstices flatter.

The female differs from the male in having the labrum entirely black, with the five central teeth sharper, and the third joint of the antennæ metallic black; the vertex is more abruptly declivous; the lateral apical angle of the elytra is sharper; the trochanters are dark, the whole tibiæ being cyaneous, and the anterior and intermediate tarsi are less dilated.

Length ♂ 26, ♀ 27 millim.

MADRAS: Coonoor, Nilgiri Hills, Dindigul.

Type in coll. W. Horn.

It has recently been taken by Mr. H. L. Andrewes on the Nilgiri Hills with *N. subclavata*, and also in the Ouchterlony Valley at a height of 3000–3500 feet.

I am much indebted to Dr. Horn for kindly allowing me to see a specimen both of the type and the variety; they differ so much in general appearance that it is not surprising that he at first described them as separate species, but I think that he is right in uniting them as varieties of one species.

4. Collyris mniszechi, *Chaud.*

Collyris mniszechi, Chaudoir, Rev. Mag. Zool. 1864, p. 75; id., Ann. Soc. Ent. France, 1864, p. 492.
Collyris robusta, Dohrn, Stettin. Ent. Zeit. 1891, p. 252; W. Horn, Stettin. Ent. Zeit. 1896, p. 176.
Collyris dormeri, W. Horn, Deutsche Ent. Zeitschr. 1898, p. 196.
Var. *Collyris gigas*, Lesne, Bull. Soc. Ent. France, 1901, p. 361.

Dark, strongly or slightly metallic, very variable both in colour and sculpture. The species is closely allied to the preceding, from which it appears chiefly to differ in having the pronotum a little narrower at the base, and with its inflated portion more ovate, more convex, and more dilated at the sides: moreover the constriction before the base is deeper; towards the sides it is punctured and pilose: the elytra are less elongate, only about half as broad again as the pronotum, with the shoulders more quadrate and the apical and basal portions more obsoletely and scantily punctured, and the central portion more or less plicate; the sternum is pilose and the apical portion of the abdomen is concolorous with the other segments.

The female is larger than the male, with the pronotum more abruptly narrowed in front, the elytra more broadly truncate, and the apical joint of the antennæ shorter.

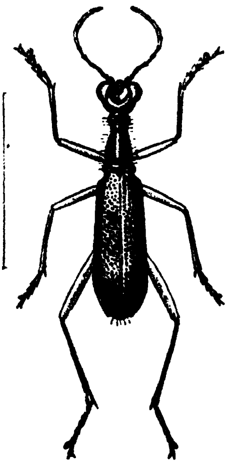

Fig. 101.
Collyris mniszechi.

Length 22–27 millim.

Assam : Naga Hills ; Burma : Karen-ni, Momeit ; Laos ; Malacca ; Java (?) ; Borneo.

There is a specimen in the Oxford Museum labelled Mysore, but almost certainly in error.

The sculpture and colour of this extremely scarce species appears to vary very considerably. The two specimens from Momeit and the Naga Hills, which were taken by Doherty and are in the Fry collection, have the front part violaceous, and the elytra, especially behind, with a bright crimson-copper reflection ; the antennæ, except the basal joint, are almost entirely red.

In an article entitled "Die *Archicollyris*-Arten" (Deutsche Ent. Zeitschr. 1907, p. 421) kindly sent me by the author, Dr. Horn, he briefly discusses the question of the synonymy and locality of *C. mniszechi*, and alludes to his determination of the specimen in rather bad condition in the Hope Museum, Oxford, labelled *C. grandis*, as a male of that species : there appear to be two races of *C. mniszechi*, one formerly named by Dr. Horn as *C. dormeri*, and the other the typical form ; the former, which must now be known as subsp. or var. *dormeri*, is distinguished by the longer and narrower elytra, the longer and more conical prothorax, the upper surface of which is less convex and usually more thickly striate transversely, and the (as a rule) more strongly pronounced transverse fold in the centre of the elytra. Dr. Horn, however, believes that there is a mistake as to the locality of Hope's insect, as no other specimen of *C. mniszechi* appears to have been recorded from Peninsular India. He further remarks that the sculpture of the elytra in both races of *C. mniszechi* can easily prove misleading, and we may add that this is true of other species as well.

The following is the list of the species and localities of *Collyris* (*Archicollyris*) as at present finally settled by Dr. Horn :—

Coll. dohrni, Chaud.	Ceylon.
„ *brevipennis*, Horn, et subsp. *subtilesculpta*, Horn	Peninsular India.
„ *longicollis*, F.	Bengal.
„ *mniszechi*, Chaud., et subsp. *dormeri*, Horn	Assam, Burma, Laos, Borneo, Java?

In the "Deutsche Entomologische Zeitschrift," 1898, p. 196, Dr. Horn in describing *C. dormeri* refers to a specimen in the Oxford Museum, labelled in Chaudoir's handwriting "*caviceps* Klug, = *longicollis*, F. = *grandis*, Hope," which he believed, from recollection, ought to be referred to the first-named species. I found the specimen among the Oxford species, which Professor Poulton has kindly lent me, and forwarded it to Dr. Horn, who pronounced it to be *C. mniszechi*.

Genus **NEOCOLLYRIS.**

Neocollyris, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 45.

Type, *Collyris bonelli*, Guérin.

This genus appears to be abundantly distinct from the preceding, and comprises over a hundred species, which are almost entirely confined to India and the Malayan region; about eight occur in Tonkin and China, but the genus is not represented outside the above-named regions. They are, for the most part, small and very slender insects, with the elytra of a bright blue colour, and more or less strongly punctured; they vary however, in colour, size, and sculpture, some having the elytra with no metallic lustre, and strongly rugose in the middle. Many of them are exceedingly hard to distinguish, and the chief difference, in many cases, is found in the shape of the pronotum, which is generally more or less lagenoid or flask-shaped, and is always contracted in front into a longer or shorter collum; the elytra are very rarely, and never entirely, connate, being usually quite free, and wings are always present; the legs are elongate and all the tarsi are spongy pubescent beneath with the fourth joint asymmetrically dilated; the anterior pair are somewhat variable as to dilatation. The species are, apparently, arboreal, but very little is known of their habits; the dilated fourth joint of the tarsi is probably of use in clinging to foliage; their flight is very rapid.

The sexes are very easily distinguished, as the last abdominal tergite of the female has on its posterior margin six blunt, more or less hook-like processes, three on each side, and on the posterior margin of the last sternite there are two sharp and straight (rarely blunt and curved) short processes, which are always visible from above, even when the segment is withdrawn, and the hook-like processes hidden. The head is usually broader in the female than in the male, and in some species this is very evident, especially as regards the long portion of the vertex behind the eyes; in some species, also, the antennæ are longer in the male, and slight differences occur in the shape of the pronotum and the elytra. The tarsi have the fourth joint dilated on one side in both sexes, but are somewhat variable in different species as regards the clothing of the under surface.

Chaudoir comments on the extreme scarcity of the males as compared with the females; the latter sex is certainly the more plentiful, but I have seen a very considerable number of males in collections. The species, as a whole, are very scarce, and hardly any of them can be called common. Mr. H. Leslie Andrewes has recently informed me that he has only taken one specimen of the genus on the Nilgiri Hills in a year, although several species occur in this district.

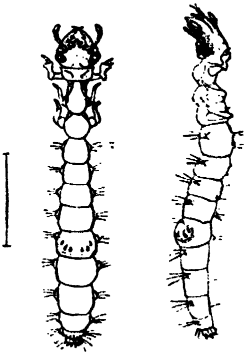

Fig. 102.—Larva of *Neocollyris emarginata*, Dej. (after Shelford).

Very little is known of the life-history of the group; but the larva of a species, which has been referred to *Collyris emarginata*, Dej., has been found making burrows in the fine twigs of the coffee-shrub. It apparently lives in these and preys on the aphides, small ants, etc., which approach the entrance of the burrow; its habits therefore are analogous to those of the larvæ of *Cicindela*, though they differ widely in habitat. As so little is known of the genus it may perhaps be well to quote at length Mr. R. Shelford's notes (Proc. Ent. Soc. Lond. 1905, pp. lxxii–iii), in which he gives an account of habits of the larva:—

"In "Mededeelingen uit's Lands Plantentuin" xliv, 1905, p. 113, Dr. J. C. Koningsberger of the Buitenzorg Zoological Museum, published a brief notice of the larva of the Cicindelid beetle, *Collyris emarginata*, Dej., burrowing the twigs of coffee-shrubs. I noticed a preparation illustrating this remarkable habit for a Cicindelid larva in the Museum at Buitenzorg, in March of this year, but it was inside a locked case, and, as Dr. Koningsberger was on leave in Europe, I was unable to make a close examination of the larva and its burrow. In answer to a request for material and information on the species, Dr. Koningsberger has kindly sent me the specimens which I now have pleasure in exhibiting to this Society. Dr. Koningsberger tells me that the larva feeds on the ants and aphides that crawl over the coffee twigs; pupation takes place in the burrow; oviposition has not been witnessed, nor have any but full grown or nearly full grown larvæ been found, so that it is not known if the burrow is enlarged to allow of the increase in size of its occupant, or if it is originally made large enough to accommodate the larva throughout its life. A figure of the larva is published in the above-mentioned work (fig. 59), but it is evidently only a copy of the figure of a Cicindelid larva in Packard's Guide to the Study of Insects, and is quite inadequate."

Since the above was written Mr. Shelford has published a full description (with figures) of the larva, which is now assigned without doubt to *Collyris emarginata*, Dej. (Trans. Ent. Soc. Lond. 1907, pp. 83–88, pl. iii) and has added various notes concerning the peculiar genital armature of *Collyris* and its use. I had a good deal of correspondence with Mr. Shelford, before his paper appeared, on the formation of the hooks and appendages, and quite agree with his conclusions. As no other larva of *Collyris* appears to be definitely known it may be well to append the chief points of his long and detailed description :—

Largest specimen 12 millim. in length. The head is typically that of a Cicindelid, being strongly chitinized, swollen and concave beneath and flattened above ; the mouth-parts are prominent and point in an upward direction. The mandibles are strong and curved and each bears a tooth on its inner margin at the centre ; the space beyond this tooth is grooved anteriorly and near it the edge is sharp. The larva is therefore plainly carnivorous and not in any sense lignivorous, but is apparently able to excavate an unresisting substance such as the pith of the twigs in which it lives. The body consists of thirteen segments and is seen at once to differ from that of a typical Cicindelid larva by the absence of a marked sigmoid flexure and by the absence of large dorsal tubercles armed with strong hooks on the eighth segment ; this eighth segment, however, to a large extent retains its Cicindelid character, for it is swollen into a hump dorsally, and the hump is furnished with three small hooks on each side, and with numerous stout setæ, both the hooks and setæ being directed forwards ; the twelfth segment is much narrower and very much shorter than the preceding, and the thirteenth is small and sucker-like with six short spines and numerous fine setæ on its posterior margin ; segments 4–12 bear at the sides a small warty process or tubercle furnished with three setæ. The legs are moderately long, the front pair being stout and adapted for digging out the pith of the twig in which the larva lives ; the second and third pairs are carried with the femora straight out from the body, and with the tibiæ bent upwards. These and the mamilliform setose tubercles at the sides of the body and the armature of the eighth segment evidently brace the insect in its burrow, and prevent it from being pulled out of it by the struggles of larger insects which it may catch.

The mouth of the burrow is counter-sunk (a structure which has been observed by Mr. A. H. Hamm in the sand-burrows of the British CICINDELIDÆ), and Mr. Shelford says that he has no doubt but that the lower surface of the head of the *Collyris* larva fills completely the orifice of the burrow when the insect is awaiting its prey, the jaws projecting into the counter-sunk area.

The adult *C. emarginata*, according to those who have observed it, is arboreal in its habits, being remarkably fleet and taking readily to wing. Mr. Shelford says that in Borneo it is mimicked by a flower-haunting fly of the genus *Sepedon* (Proc. Zool. Soc. 1902 (2) p. 264) ; it feeds on small insects and is not herbivorous.

The species of the genus *Neocollyris* are, in many cases, very hard to distinguish, and a considerable number have been described on very scanty material ; this is, perhaps, inevitable owing to the rarity of the members of the genus generally. At present, therefore, they may be regarded as one of the most difficult genera of the whole of the Coleoptera, it being quite impossible, in many cases, to determine them without careful comparison with the type-specimens, which are very scattered; moreover, the specific value of some of these appears somewhat doubtful. About fifty species occur in the Indian region; a key to these is given in the following table, and I am much indebted to Dr. Horn for help in its compilation. It must, however, be regarded as provisional and as merely a general help towards the identification of the species, it being impossible, in the present state of our knowledge, to draw up a really satisfactory dichotomous table of the genus.

Key to the Species of Collyris.

I. Small and slender species (8-13 mm.), with the eyes less prominent, the vertex longer and narrower (especially in the males), and the elytra more closely and finely punctured, the punctures not being elongate at apex (except in *N. plicicollis*, W. Horn); colour green, blue, or violaceous, metallic.

i. Labrum short.

1. Labrum, as a rule, mostly yellow; anterior pairs of femora dark, except apex and base; elytra longer and narrower .... *brevilabris*, W. Horn, p. 238.

2. Labrum black; legs testaceous; elytra shorter and broader .... *planifrons*, W. Horn, p. 239.

ii. Labrum long or comparatively long.

1. Apex of abdomen concolorous.

A. Elytra long in proportion to pronotum and head; pronotum often without a distinct collum.

a. Pronotum with a more or less distinct collum before apex; apophysis or process of underside of last abdominal segment in female sometimes consisting of a larger or shorter stalk dividing at the end into two blunt more or less curved processes, sometimes of two parallel sharp points or spines proceeding directly from the posterior margin of the segment.

*a**. Pronotum lagenoid or flask-shaped, much dilated before base, with a long and narrow collum; female with the apophysis stalked, the obtuse points being very small.

a†. Collum long and distinct...... *variicornis*, Chaud., p. 245.

b†. Collum shorter and less abrupt and distinct .... *auripennis*, W. Horn, p. 247.

*b**. Pronotum with the sides less dilated behind.

a†. Pronotum with the sides very slightly, or comparatively slightly, dilated, passing gradually into a less strongly marked collum.

a‡. Forehead deeply excavated between the eyes; metasternum deeply and closely punctured; female with the apophysis stalked .... *variitarsis*, Chaud., p. 241.

b‡. Forehead slightly excavated between the eyes; metasternum less deeply and closely punctured, with the sides especially less punctured; female with the apophysis stalked .... *subtilis*, Chaud., p. 240.

c‡. Forehead flat between the eyes, not excavated.

*. Tibiæ testaceous; apophysis consisting of two parallel points proceeding directly from the posterior margin.

†. Metasternum punctate; elytra less elongate; shoulders obsolete .... *attenuata*, Redt. (*maculicornis*, Chaud.). p. 240.

††. Metasternum smooth; elytra more elongate; shoulders marked .... *redtenbacheri*, W. Horn (*attenuata*, Chaud.), p. 239.

**. Tarsi and posterior tibiæ cyaneous; antennæ slightly thickened to the end, with the last joints shortened.

†. Metasternum somewhat punctate .... *punctatella*, W. Horn, p. 248.

††. Metasternum not punctate .. *plicicollis*, W. Horn. p. 272.

b†. Pronotum with the sides distinctly dilated behind and with a distinct collum; female with the apophysis always consisting of two sharp parallel points proceeding directly from the posterior margin (female of *N. kollari* not known).

a‡. Labrum more or less testaceous; legs entirely red §.... *linearis*, Schm.-Goeb., p. 243.

b‡. Labrum unicolorous black; tarsi entirely, and posterior tibiæ almost entirely, pitchy or cyaneous.

*. Elytra longer with the shoulders rounded; anterior and intermediate tibiæ red.. *parvula*, Chaud., p. 244.

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§ The var. *tenuicornis*, Chaud., which has the legs in part darker, has not occurred in India; it is, perhaps, a separate species.

**. Elytra shorter with the shoulders rectangular; all the tibiæ cyaneous .... *kollari*, W. Horn, ♂, p. 245.

b. Pronotum without collum; female with the apophysis consisting of two sharp parallel points proceeding directly from the posterior margin.

*a**. Frontal excavation strongly carinate between the eyes; legs testaceous; pronotum with the sides straight between the basal and apical constrictions; antennæ slightly thickened to the apex, with the last joints shortened .. *roeschkei*, W. Horn, p. 247.

*b**. Frons almost flat between the eyes, with a very slight carina; tibiæ brownish; pronotum conical, with the surface strongly transversely plicate; antennæ quite filiform, with all the joints very long .... *ceylonica*, Chaud., p. 272.

B. Elytra very short (5 mm.) in proportion to the pronotum and head (4 mm.); pronotum with distinct long anterior collum; the smallest known species of the genus ...... *maindroni*, W. Horn, p. 245.

2. Apex of abdomen yellow; a small metallic green species with red legs .... *schaumi*, W. Horn, p. 242.

II. Intermediate species (average size, as a rule, 13-15 mm.), with the head shorter in proportion, the vertex shorter and more widened behind the eyes, the eyes more prominent, and the elytra evidently more strongly punctured; colour metallic, blue or green, with occasional dark varieties.

i. Elytra with the punctuation not (or only occasionally in some specimens) elongate before apex.

1. Apophysis of the last ventral segment of the female consisting of two sharp parallel points proceeding directly from the posterior margin.

A. Posterior tibiæ clear red .... *fuscitarsis*, Schm.-Goeb., [p. 256.

B. Posterior tibiæ dark.

a. Pronotum strongly dilated before the basal constriction .... *bonelli*, Guér., p. 248.

b. Pronotum moderately or slightly dilated before the basal constriction.

*a**. Pronotum shorter, and less slender and parallel-sided .... *bonelli*, var. *ortygia*, Buq., [p. 250.

*b**. Pronotum longer, slender, and more parallel-sided.

a†. Forehead deeply excavated; colour bright blue or greenish; posterior tarsi dark .... *distincta*, Chaud., p. 250.

b†. Forehead not deeply excavated; colour dark cyaneous, violaceous or almost black; posterior tarsi testaceous .... *mæsta*, Schm.-Goeb., p. 251.

2. Apophysis of the last ventral segment of the female consisting of a short stalk dividing into two blunt or rounded curved processes.

A. Head less contracted behind .... *rufipalpis*, Chaud., p. 254.

B. Head more contracted behind.

a. Elytra dilated behind .... *lesnei*, W. Horn, p. 253.

b. Elytra parallel-sided .... *similis*, Lesne, p. 254.

ii. Elytra with the punctuation more or less distinctly elongate before apex.

1. Pronotum strongly constricted at base, with the sides strongly dilated and rounded before the short collum; colour variable, but usually dark with a violaceous reflection .. *cruentata*, Schm.-Goeb., p. 252.

2. Pronotum feebly constricted at base and gradually narrowed until just before apex; colour cyaneous .... *cylindrica*, Schm.-Goeb., p. 255.

III. Larger species (average size 15–22 mm.; rarely smaller §).

i. Head long and narrow, vertex long, eyes moderately prominent; colour dark or blue-black with more or less obscure metallic reflections; pronotum before base cylindrical and abruptly constricted into a distinct collum; punctuation of elytra strong, elongate before apex .... *cylindripennis*, Chaud., [p. 252.

ii. Head shorter and broader.

1. Colour green, blue, violaceous, or blackish.

A. Antennæ strongly thickened towards apex.

a. Pronotum shorter, strongly dilated before base, the dilatation being sometimes almost globular; collum very distinct .... *crassicornis*, Dej., p. 261.

b. Pronotum longer, not strongly dilated before base and passing gradually into the collum.

*a**. Colour usually blue or violaceous; pronotum less slender, with at most very feeble transverse striation; punctuation of elytra less coarse .... *subclavata*, Chaud., p. 262.

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§ Specimens of *N. crassicornis* (male) and *N. subclavata*, occasionally occur which do not exceed 11½ or 12 mm. in length; in these exceptional cases, the body and general form is stouter and broader than in the preceding group. *N. saundersi* is also an intermediate species as regards size, but is very distinct by reason of its long slender pronotum and very coarse punctuation.

*b**. Colour black; pronotum more slender, strongly striate transversely; punctuation of elytra very coarse .... *saundersi*, Chaud., p. 259.

B. Antennæ not strongly thickened towards apex.

a. Antennæ long or very long, filiform to the end; pronotum very long and narrow, densely and regularly plicate transversely.

*a**. Size much larger; length 19–20 mm.

a†. Frontal excavation broader, with distinct striæ behind the eyes; metasternum finely and closely punctured in the middle; punctuation of elytra less coarse .... *andrewesi*, W. Horn, p. 270.

b†. Frontal excavation much narrower, without striæ behind the eyes; metasternum impunctate; punctuation of elytra very coarse .... *plicaticollis*, Chaud., p. 270.

*b**. Size much smaller; length 14 mm. .... *nilgirica*, sp. n. §, p. 260.

b. Antennæ seldom quite filiform to the end; pronotum shorter and, at least on basal half, broader, and not densely plicate transversely.

*a**. Pronotum more dilated behind and much less contracted in front; body very stout........ *crassicollis*, Chaud., p. 259.

*b**. Pronotum less dilated behind; body less stout, sometimes rather elongate.

a†. Pronotum cylindrical, without well-developed collum ...... *saphyrina*, Chaud., p. 257.

b†. Pronotum with well-developed collum.

a‡. Base of elytra strongly punctured; antennæ long ...... *insignis*, Chaud., p. 258.

b‡. Base of elytra finely punctured; antennæ shorter............ *smaragdina*, W. Horn, p. 258.

2. Colour, as a rule, brassy, bronze, or coppery, shining ‖; pronotum dilated behind but without very distinct collum; elytra very strongly punctured in the middle, sparingly towards base .... *orichalcina*, W. Horn, p. 263.

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§ As regards size this species ought to belong to the preceding section, but in other respects it agrees better with members of this section; it must be regarded therefore as exceptional; it was added after the table was drawn up.

‖ Dr. Horn tells me that he has specimens from Yunnan, which are cyaneous blue, but I have not seen or heard of an Indian specimen of this colour.

3. Colour dark brown, pitchy, or rufo-castaneous (occasionally with a slight metallic reflection), with the apex of the elytra often lighter; middle portion of the elytra more or less roughly plicate.

A. Elytra densely punctured to apex, with the apical punctures elongate.

a. Size larger; pronotum longer; sculpture of the apex of the elytra less marked, central portion with more plicæ .... *feæ*, W. Horn, p. 264.

b. Size smaller; pronotum much shorter; sculpture of the apex of the elytra very strongly marked, central portion with fewer plicæ .. *bipartita*, Fleut., p. 264.

B. Apical third of elytra never densely punctured with elongate punctures, often almost smooth.

a. Antennæ quite filiform to the end, all the joints long, last joints not shortened .... *rubens*, Bates, p. 269.

b. Antennæ slightly thickened towards apex, or, at least, with the last joints a little thickened.

*a**. Pronotum very long and slender, with a long thin collum.

a†. Basal third of elytra remotely, and often very sparingly, punctured .... *sarawakensis*, Thoms., p. 268.

b†. Basal third of elytra thickly and coarsely punctured, more or less rugose .... *sarawakensis* var. *dohertyi*, W. Horn, p. 269.

*b**. Pronotum variable, sometimes much dilated, with a well-marked collum, at other times passing gradually into the collum, but always less elongate, stouter and less sculptured than in the preceding species.

a†. Form broader, longer (22-23 mm.); pronotum with a strong parallel-sided dilatation before the base, which is abruptly constricted into a short and very distinct collum: apical third of elytra somewhat distinctly, but not closely, punctured .... *smithi*, Chaud., p. 265.

b†. Form narrower and more slender, smaller; collum, as a rule, not so abruptly separated; apex variable, but inclined to be smooth.

a‡. The roughly plicate middle portion of the elytra very distinctly separated from the finely punctured anterior part.

  *. Size smaller (16–18 mm.); body often more or less rufescent; elytra very sparingly punctured behind the central plicæ.

    †. Frontal sulci parallel; forehead between the eyes flat.. *apicalis*, Chaud., p. 267.

    ††. Frontal sulci convergent; forehead between the eyes foveated .... *foveifrons*, W. Horn, p. 267.

  **. Size larger (19–20 mm.); body never rufescent; elytra not very sparingly punctured behind the central plicæ .. *aptera*, Lund, p. 266.

b‡. The roughly plicate middle portion of the elytra gradually merging into the punctured anterior part .... *apteroides*, W. Horn, p. 266.

5. Neocollyris brevilabris, *W. Horn.*

Collyris brevilabris, W. Horn, Ann. Mus. Genova, 1893, p. 381.

Head elongate-ovate, roundly inflated behind the eyes; labrum very short, whitish yellow, with seven teeth, the sides and base being very narrowly dark; forehead slightly impressed, with the longitudinal furrows at the sides deep and parallel, the space between somewhat convex; antennæ dark at base, lighter in middle, darker towards apex; pronotum long and slender, constricted at base, with the intermediate portion elongate-conical, the sides a little rounded, pronotal collum short, disc glabrous and shining; underside sparingly pilose; elytra elongate, narrow and parallel-sided, very finely and evenly punctured to the apex; sides of metasternum smooth; colour of upperside dark cyaneous, moderately shining, with the legs cyaneous black or black, the central portion of the posterior femora being red and the trochanters pitchy. The male, apparently, does not differ appreciably from the female.

Length 8–10 millim.

ASSAM; BURMA: Karen Hills.

This is a very small species and, according to Dr. Horn, differs from all the described species of the genus in its very short yellow labrum and scarcely excavate forehead.

The only specimen which I have seen is a female of a variety from Martaban, S.E. Borneo, which had the labrum very short but mostly dark and the legs yellow, except the femora which are mostly dark, the base only and the extreme apex of the intermediate and posterior pairs being yellow. The specimen is named by Dr. Horn and is in Mr. Nevinson's collection. Dr. Horn has also described a variety or subspecies from Sumatra under the name *weyersi*.

6. Neocollyris planifrons, *W. Horn.*

Neocollyris planifrons, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 293.

This species is closely allied to *N. brevilabris*, from which it differs in having the labrum black and a little longer, with sharp teeth, the central one being a little shorter than the adjacent ones; the head and the elytra are shorter and broader, and the sculpture of the latter is very slightly finer, the punctures being a little more separated; the head and pronotum are shorter and thicker than in *N. maindroni*, the forehead also being much flatter and less excavate behind, and the labrum is shorter; from *N. parvula* it may be distinguished by its shallow forehead, short labrum, and by not having the pronotum strongly contracted in front; and from *N. linearis*, *N. variitarsis*, and *N. subtilis* by its short labrum, shorter head, and less excavate forehead; the sculpture of the elytra, too, is finer and less close than in the first two of these species.

Length 9½ millim.

CEYLON.

Only one female has been hitherto discovered.

7. Neocollyris redtenbacheri, *W. Horn.*

Collyris attenuata, Chaudoir (*nec* Redt.), Ann. Soc. Ent. France, 1864, p. 523, pl. 9, fig. 19.

Collyris redtenbacheri, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 12.

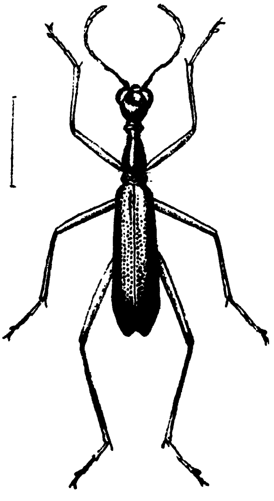

Fig. 103. *Neocollyris redtenbacheri.*

Of a bright greenish or bluish-green colour, more or less coppery; antennæ long and slender, very slightly thickened, these and the palpi being lighter in the male than in the female; labrum large, with seven very distinct teeth, the three central ones being broad and blunt; they are, however, somewhat variable; head longer than broad, vertex moderately long, the intermediate space before the eyes small; pronotum slender, much constricted before base, elongate conical, with the pronotal collum almost or quite merged into the posterior portion; anterior margin reflexed, disc smooth, very finely striolate, sides and underside sparingly but plainly pilose; elytra long, narrow, parallel-sided, with the shoulders oblique, distinctly, closely, and regularly punctured, the punctures becoming finer at the apex which is dentate and somewhat excised near the suture: legs rufo-testaceous, the extreme apex of the anterior and intermediate tibiæ and the tarsi being sometimes pitchy. Male with the head more ovate than in the female, the antennæ longer, and the pronotum longer and more slender in front.

Length 12 millim.

PUNJAB: Simla; SIKKIM: Mungphu; NEPAL; ASSAM: Khasi Hills, Naga Hills, Patkai Hills; BURMA: Arakan; TENASSERIM.

8. **Neocollyris attenuata**, *Redt.*

Collyris attenuata, Redtenbacher, Hügel's Kaschmir, iv, 1848, p. 498.
Collyris maculicornis, Chaudoir, Bull. Soc. Moscou, 1850, i, p. 19; id., Ann. Soc. Ent. France, 1864, p. 524.

Allied to *N. redtenbacheri*, from which it differs in having the five intermediate teeth of the labrum strong and blunt, and the exterior one on each side sharp and a little separated from the rest, and also in having the elytra more elongate, with the shoulders more obsolete, and the whole upper surface more finely and closely punctured, the punctures in the middle being thicker but not larger; the head is a little longer, with the sides less rounded behind the eyes, and the frontal sulci stronger and somewhat curved; the pronotum is a little shorter, but does not differ materially; the antennæ are variable in colour, but the terminal joints are often indistinctly dark at the apex; from *N. variitarsis* the species differs in having the head broader behind, the pronotum less elongate and less slender, and in the somewhat broader elytra.

Length 12½–13 millim.

PUNJAB: Simla; BENGAL: Calcutta; SIKKIM; ASSAM.

It seems doubtful whether the preceding species is not merely a variety of the present one.

9. **Neocollyris subtilis**, *Chaud.*

Collyris subtilis, Chaudoir, Rev. Mag. Zool. 1863, p. 111; id., Ann. Soc. Ent. France, 1864, p. 525.
Collyris brachycephala, W. Horn, Ann. Mus. Genova, 1893, p. 378.

A small, very slender coppery-green or violaceous species, closely allied to *N. attenuata*, but smaller, with the head narrower and more elongate; this character, however, is variable; the forehead is less deeply excavate and the sulci on each side are not so strong; the pronotum is evidently more slender and the pronotal column even less marked: the elytra are narrower, with the shoulders more obsolete, but quite as strongly punctured, and the sides of the metasternum are impunctate; the antennæ are dark at base and then rufescent, and the legs are variable in colour, being yellowish-red or partly dark. The male and female do not appreciably differ.

Length 10–12 millim.

MADRAS: Palni Hills, Kodaikanal (*W. H. Campbell*, August, 1904); BURMA: Karen Hills; SIAM; SUMATRA; JAVA.

Var. **brachycephala**, *W. Horn.*

This variety differs from the type in having the head much shorter and less attenuated, more convex and broader behind the eyes; the palpi, legs, and trochanters are red and the apex of the tibiæ is sometimes darker. Dr. Horn says that the formation of the head in this variety is very remarkable, being more quadrate, with the vertex much less long and broader than in the type-form; intermediate forms, however, occur.

Length 9–10 millim.

BURMA: Karen Hills.

The small size and very narrow pronotum with the sides scarcely dilated before its base will easily distinguish this species.

10. **Neocollyris variitarsis**, *Chaud.*

Collyris variitarsis, Chaudoir, Bull. Soc. Moscou, 1860, p. 295; id., Ann. Soc. Ent. France, 1864, p. 523.
Collyris schmidt-goebeli, W. Horn, Ann. Mus. Genova, 1893, p. 378.
Collyris brachycephala, W. Horn, op. cit. p. 379.

Variable in size, cyaneous blue, with the elytra sometimes green, and occasionally with a narrow line below the shoulders and a transverse central fascia reddish; head narrow, conically elongate below the eyes, with the frontal sulci straight and not approximate behind; pronotum elongate, much longer than the head with the labrum, slightly constricted at the base, with the intermediate part subovate, subparallel-sided, the pronotal collum not marked, the disc not striate, but with the upperside rather closely punctured and the base usually rugosely punctured; elytra narrow, very long, parallel-sided, closely and rather finely sculptured throughout, the punctures being a little smaller and less close at the apex; sides of the pro-, meso-, and meta-sternum thickly punctured; antennæ slightly thickened towards the apex, with the first two joints cyaneous black, and the rest mostly flavo-testaceous; legs dark, femora more or less rufescent. Head longer and narrower in the male than in the female.

Length 9–13 millim.

BENGAL; SIKKIM: Darjiling, Sukna; NEPAL; ASSAM: Dunsiri Valley, &c.*; BURMA: Karen Hills, Teinzo; TENASSERIM; PENANG; TONKIN.

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* The Assam insect has the elytra green and the pronotum broader, less conical, and slightly dilated and rounded at the sides (*vide* Horn, D. E. Z. 1901, p. 45).

Var. brachycephala, *W. Horn.*

This variety differs from the type in having the head much shorter, more inflated and rounded behind the eyes, elongate ovate and not conical, and with the forehead less excavate.

Length 11–11½ millim.

BURMA: Bhamo, Karen Hills, Rangoon.

The species is rather closely allied to *N. subtilis* from which it differs in its average large size, broader head, longer and more closely punctured pronotum which is more narrowed in front, the slightly deeper and closer punctuation of the elytra and the dense punctuation of the sterna.

Dr. Annandale (Annotated List, i, p. 2) says that this insect is common among undergrowth in dense jungle, and that it is fond of resting on the leaves of shrubs, but is easily disturbed and is very active on the wing. He further adds that all the Indian and Malayan species of the genus with which he is acquainted have similar habits. They frequent especially those parts of the jungle in which patches of light filter through the upper foliage.

11. **Neocollyris schaumi**, *W. Horn.*

Collyris schaumi, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 366.
Var. *Collyris chevrolati*, W. Horn, ibid., 1894, p. 16.

Allied to *C. variitarsis*, Chaud., from which it differs in having the last segment of the abdomen yellow, the antennæ, palpi, and legs testaceous, the head flatter between the frontal sulci, the pronotum very finely striate transversely, and the elytra thickly covered with very small punctures, which are deep, but less strong towards the base and apex; the sides of the meso- and metasternum are punctured and pubescent. The yellow apex of the abdomen will separate it from all other known species.

Length 10 millim.

ANDAMAN ISLANDS.

Var. chevrolati, *W. Horn.*

This variety differs from the type-form in having the head a little broader behind the eyes, and the pronotum and elytra much shorter; the former is impunctate above and less punctured on the underside, and the elytra are a little broader behind and less closely sculptured at the apex; fine rufous lines, more or less distinct, are present on the margins, one at the shoulder and another in the middle, and there is an obscure median fascia; the legs are fulvo-testaceous, with the tarsi and the apex of the tibiæ darker; the sculpture is plainly coarser than in *N. attenuata*, Redt., and the thorax is shorter and more strongly rounded than in the latter species. It occurs in the same locality as the typical form.

12. **Neocollyris linearis,** *Schm.-Goeb.*

Collyris linearis, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 15; W. Horn, Ann. Mus. Genova, 1893, p. 379.
Var. *Collyris srnkæ*, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 15.

A long narrow species, green or greenish cyaneous; head long, labrum large, whitish testaceous in the middle with the sides dark, but variable; impression between the eyes deep, sulci parallel; antennæ rufescent, darker towards apex, slightly thickened; vertex very long, smooth and shining; pronotum very long and slender, rather deeply constricted before the base, intermediate portion slightly rounded at the sides, pronotal collum rather long, more or less distinct from the hinder portion; upper surface very finely striate in front, smooth and shining behind, underside very sparingly pilose, with scattered punctures; metasternum variable in punctuation; elytra with or without a light band in centre, long, parallel-sided, strongly and evenly punctured, somewhat rugosely in the middle, the apex almost impunctate; legs variable, entirely reddish testaceous, or more or less pitchy.

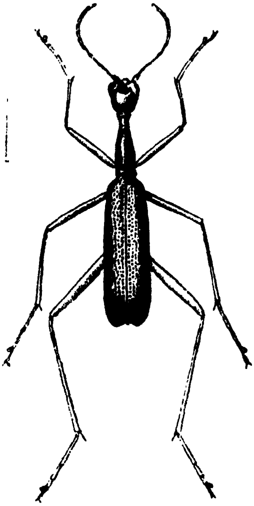

Fig. 104.
Neocollyris linearis.

Length 10–13 millim.

ASSAM; BURMA: Maymyo, Pegu; SAIGON; SIAM.

Occasionally, according to Dr. Horn, the white patch of the labrum is smaller, and there is a very fine reddish line along the lateral border of the elytra behind the shoulder, which is more or less marked. The colour of the legs is very variable.

Var. **srnkæ,** *W. Horn.*

This variety differs from the type in its narrower pronotum, which is almost linear in some specimens and shows very small traces of a distinct pronotal collum; the colour of the elytra is coppery green, and they are a little more finely punctured towards the base; the legs are entirely reddish testaceous with the upper surface of the femora darker, but this may be variable.

Length 10–11 millim.

BURMA: Pegu District, &c., Ruby Mines (*Doherty*); CHINA.

Collyris linearis, Chaud., may be a different insect from this species and appears to be only a variety of *C. parvula*, differing chiefly in the colour of the labrum and legs.

The var. *tenuicornis* (Chaud., Ann. Soc. Ent. France, 1864,

p. 526), which occurs in Singapore, Sumatra and Java, has the pronotal collum more marked, and the elytra a little broader and more coarsely and rugosely punctured.

N. linearis is very closely allied to *N. subtilis*, but differs in its larger size, smoother pronotum, and more evenly punctured elytra.

13. **Neocollyris parvula**, *Chaud.*

Collyris parvula, Chaudoir, Bull. Soc. Moscou, 1848, p. 17; id., Ann. Soc. Ent. France, 1864, p. 527.
Var. *Collyris amœna*, Chaudoir, op. cit., 1860, p. 295.

Cyaneous or more or less violaceous; head moderately long, labrum cyaneous, unicolorous; forehead moderately excavate, the excavation being somewhat narrowed in front, as the eyes are closer together before the labrum than in the allied species; vertex behind the eyes long and smooth; antennæ rufescent, pitchy towards apex, first joint cyaneous, second joint pitchy: pronotum long, not strongly constricted at the base, with the portion before this moderately rounded and passing gradually into the distinct pronotal collum, which is slightly, but distinctly, dilated at the apex; upper surface rugose transversely, underside smooth and very sparingly pilose; elytra narrow, with the shoulders not marked, evenly and rather strongly punctured until just before the apex, where they are nearly smooth; legs rufo-testaceous, with the tarsi and most of the posterior tibiæ black-cyaneous; episterna of metasternum smooth. In the male the eyes are a little more convex and the head is a little more narrowed behind, but the differences are hardly appreciable.

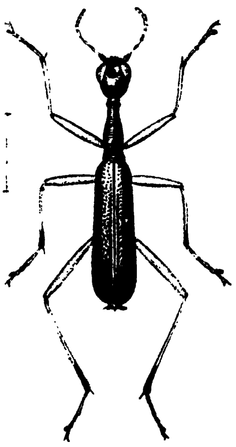

Fig. 105.
Neocollyris parvula.

Length 9½–10½ millim.

Bombay: North Kanara, Belgaum.

Var. **amœna**, *Chaud.*

This variety, which is found with the type, differs chiefly in being of a greenish or olivaceous colour with the tibiæ and tarsi blackish and slightly metallic. Apart from this, the differences are so slight that it can hardly be regarded as even a variety: it occurs with the type and with intermediate forms, as pointed out by Dr. Horn (Deutsche Ent. Zeitschr. 1894, p. 169).

14. Neocollyris maindroni, *W. Horn.*

Neocollyris maindroni, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 294.

Closely allied to *N. parvula*, from which it differs in having the last joint of the antennæ longer, the central longitudinal portion of the forehead indistinctly dilated behind (the sulci not being parallel as in *C. parvula*), the pronotum longer and much narrower, the pronotal collum longer and more cylindrical, and the elytra shorter and a little more finely sculptured. The species has the shortest elytra in proportion to the relatively longest pronotum in its group.

Length 9–10 millim.

MADRAS: Walladi in Travancore, Nilgiri Hills (*H. Leslie Andrewes*).

The specimen from the Nilgiri Hills is of a dark greenish colour, and not cyaneous.

15. Neocollyris kollari, *W. Horn.*

Neocollyris kollari, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 47.

Allied to *N. parvula*, from which species it differs in having the head a little more ample, with the vertex less triangular, and the forehead level in front and much more deeply and widely excavate; the pronotum is shorter and broader, less parallel-sided behind, and more plainly constricted in front, the pronotal collum being rather long and narrow; the upper surface is obsoletely striolate transversely and moderately punctured at the sides; the episterna of the pronotum are very finely striate at the sides and rather coarsely punctured near the coxæ; the elytra are much shorter than in *N. parvula*, and a little broader, especially behind, with the shoulders more rectangular, and the sculpture very slightly closer and coarser; the tibiæ and tarsi are cyaneous.

The pronotum is not so strongly narrowed in front of the posterior dilatation as in *C. variicornis* and is consequently not so evidently lagenoid or flask-shaped; it differs also from the latter species in other particulars.

Length 9 millim.

CENTRAL INDIA.

16. Neocollyris variicornis, *Chaud.*

Collyris variicornis, Chaudoir, Ann. Soc. Ent. France, 1864, p. 530.
Var. *Collyris flavolabiata*, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 366.
Var. *Collyris gestroi*, W. Horn, Ann. Mus. Genova, 1893, p. 380.

Cyaneous, with the elytra cyaneous, greenish bronze, or coppery the tints being variable; head long behind the eyes (which are large and moderately prominent), smooth and shining, frontal impression rather strong with the sulci deep, sides more rounded in the female than in the male; labrum partly testaceous, more or less pitchy; antennæ variable in colour, rufo-testaceous, more or less pitchy; pronotum long, flask-shaped, moderately strongly constricted at the base, with the dilated part much broader and more rounded at the sides than in *N. parvula*, pronotal collum very distinct, slender, parallel-sided, and scarcely dilated at the apex; upper surface smooth and shining with a few feeble scattered punctures, underside rather strongly pilose: elytra evenly and rather strongly punctured with a tendency to become slightly rugose in places (but this varies in different specimens), nearly smooth at the apex, shoulders not marked; legs rufo-testaceous, tibiæ and tarsi more or less pitchy; metasternum distinctly punctured; in the female the two projecting points at the apex of the last ventral segment spring from a small plate projecting from the margin, and not from the margin itself.

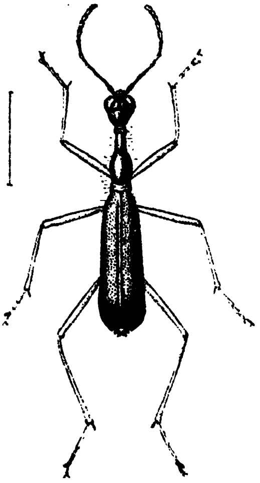

Fig. 106.
Neocollyris variicornis.

Length 12–12½ millim.

Sikkim: Upper Teesta Valley, E. Himalayas, 4000 ft.: Assam: Sylhet, Khasi Hills, Patkai Hills, Naga Hills: Burma: Tharawaddy; Malay States: Bukit Besar, Nawngchik, 2500 ft., May to September (*Robinson*).

Var. **flavolabiata**, *W. Horn.*

Dr. Horn first introduced this variety as a species allied to *N. parvula*, from which it may be at once known by the dense punctuation of the sterna; it differs from the type-form of *N. variicornis* in having the labrum and the legs almost entirely testaceous, and in its small size.

Length 9 millim.

Andaman and Nicobar Islands (*Cornwallis* and *de Roepstorff*).

Var. **gestroi**, *W. Horn.*

This variety is closely allied to the preceding, but differs in its larger size and in having the anterior and posterior portions of the pronotum longer, so that the whole form appears more slender;

the base of the pronotum is rugosely punctate; from the type-form it appears to chiefly differ in the colour of the labrum and the more slender pronotum.

Length 10½–12½ millim.

BURMA: Karen Hills; TENASSERIM.

17. Neocollyris auripennis, *W. Horn.*

Neocollyris auripennis, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 7.

Rather closely allied to *N. variicornis*, but with the collum of the pronotum shorter, less abrupt, and less distinct; the elytra are of a metallic green colour with bronze or golden reflections, and the sculpture is somewhat closer and more rugose; the head is a little more excavate between the eyes and the legs are darker. As, however, intermediate specimens occur, it is quite possible that the insect is only a variety of *N. variicornis*.

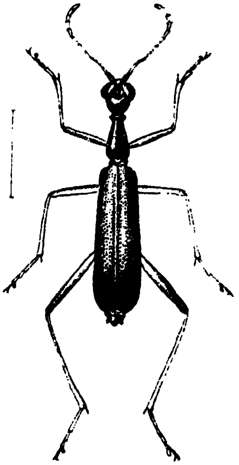

Fig. 107.—*Neocollyris auripennis.*

Length 11–12 millim.

ASSAM: Manipur; TONKIN.

18. Neocollyris roeschkei, *W. Horn.*

Neocollyris roeschkei, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 365*.

Elongate and parallel-sided, with the labrum anteriorly yellow in the centre, the head quadrate, convex between the lateral sulci

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* Dr. Horn (D. E. Z. 1901, p. 48) mentions *N. aureofusca*, Bates, as recorded doubtfully from Kashmir; but as it appears to be a Chinese species, it is best to omit it from the Indian list until its occurrence within our limits has been reliably confirmed.

and with short striæ near the eyes; pronotum with the sides straight between the anterior and posterior sulci, slightly narrowed in front, with slight transverse striation and a few scattered punctures; elytra moderately finely punctured in front, but coarsely punctured in and behind the middle; legs testaceous; sides of metasternum narrowly punctured.

The form of the pronotum, taken in conjunction with the sculpture of the elytra, will serve to distinguish it from its allies.

Length 12 millim.

BENGAL : Calcutta.

19. **Neocollyris punctatella**, *Chaud.*

Collyris punctatella, Chaudoir, Ann. Soc. Ent. France, 1864, p. 525.
Collyris nietneri, W. Horn, Deutsche Ent. Zeitschr. 1895, p. 357.

Allied in general appearance to *C. attenuata*, Redt., but differs in having the vertex shorter behind the eyes, which are more prominent, the frontal furrow much less impressed and less convergent, and the space between the eyes flat; the pronotum is less dilated behind and more strongly rugose on the disc, and the pronotal collum is less distinct; the sides are remotely punctured and pilose; the elytra are regularly and rather coarsely punctured almost throughout, the punctures never coalescing, except an occasional pair just before the apex: an obscure median transverse luteous band is sometimes present; the antennæ are slightly thickened and have the first five joints cyaneous (the third and fourth being rufous at the apex) and the following joints darker; the tarsi and the hind tibiæ are bluish-black.

Length 12 millim.

CEYLON : Balangoda, March.

20. **Neocollyris bonelli**, *Guér.*

Collyris bonelli, Guérin, Bélanger Voy. Ind. Or., Zool. 1834, p. 481, pl. 2, fig. 1; Chaudoir, Ann. Soc. Ent. France, 1864, pl. 7, fig. 7.
Var. *Collyris batesi*, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 355.
Var. *Collyris ortygia*, Buquet, Ann. Soc. Ent. France, 1835, p. 604; Chaud., Ann. Soc. Ent. France, 1864, p. 502, pl. 17, fig. 6.
Collyris postica, Brullé, Arch. Mus. Paris, i, p. 138, pl. 9, fig. 8; Chaud., Ann. Soc. Ent. France, 1864, p. 504.
Collyris ruficornis, Brullé, l. c. p. 139.
Collyris filiformis, Chaud., Bull. Soc. Moscou, 1843, p. 697; id., Ann. Soc. Ent. France, 1864, p. 507, pl. 8, fig. 9.
Collyris cribrosa, Chaud., Ann. Soc. Ent. France, 1864, p. 507.
Collyris melanopoda, Schmidt-Goebel, Faun. Birm. p. 13.
Collyris flavitarsis, Brullé, l. c. p. 141.
Collyris cribellata, Chaud., Bull. Soc. Moscou, 1860, p. 290.
Collyris puncticollis, Chaud., Bull. Soc. Moscou, 1860, p. 291.
Collyris terminalis, Chaud., Ann. Soc. Ent. France, 1864, p. 509.

Collyris thoracica, W. Horn, Deutsche Ent. Zeit. 1892, p. 356, & 1897, p. 50.

Collyris bonelli var. *diversipes*, nom. nov.

C. bonelli var. *cruentata*, W. Horn (*nec* Schm.-Goeb.), Deutsche Ent. Zeit. 1894, p. 224.

Variable in colour, cyaneous, blue or dark with or without a violaceous tinge. Head rather large, with the vertex wider in the male than in the female, labrum large with blunt teeth, eyes rather prominent; forehead rather strongly excavate between the eyes, not raised between the sulci which are deep and parallel; antennæ somewhat thickened towards the apex, variable in colour; pronotum stout, strongly constricted near the base and apex, intermediate portion dilated and then contracted into a very short pronotal collum, disc smooth and shining, with remote scattered punctures, but not striolate; underside punctured and pilose; elytra closely and strongly, but variably, punctured, the sculpture showing a tendency to become rugose in the middle; legs variable in colour, but with the tarsi, the tibiæ, and the extreme apex of the femora, and also the posterior coxæ, as a rule, dark; metasternum more or less punctured, the punctuation being variable.

Length 13–13½ millim.

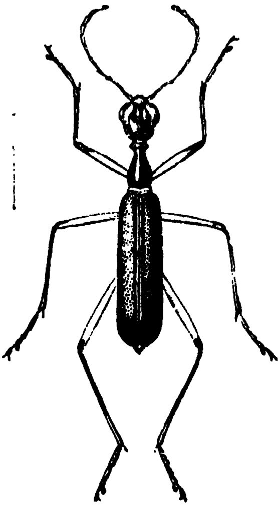

Fig. 108.
Neocollyris bonelli var. *ortygia*.

BENGAL: Calcutta; SIKKIM; ASSAM: Naga Hills and Patkai Hills (*Doherty*); BURMA: Maymyo, 3000 ft. (*Bingham*), Tharawaddy and Pegu (*Corbett*); TENASSERIM (*Doherty*): JAVA.

I am somewhat doubtful of the Calcutta locality, which rests on a single specimen in the Indian Museum.

Var. **batesi**, *W. Horn.*

Larger than the type, with the head broader and thicker: the forehead broadly excavate and furnished with a plain impression behind; the pronotum short and moderately narrowed in front, and the elytra short and coarsely sculptured; the colour is either green or violaceous.

Length 14 millim.

ASSAM: Khasi Hills; SIAM; COCHIN CHINA.

Dr. Horn introduced this insect as a new species allied to *N. saphyrina*, but now considers it to be a variety of *N. bonelli*.

Var. ortygia, *Buq.*

This variety, which is much commoner than the type-form, is closely allied to it, but chiefly differs in having the pronotum less stout and less rounded at the sides, and in the sculpture of the elytra being shallower, but closer, and more plainly rugose in the middle: intermediate forms, however, occur, and it is doubtful whether it ought even to be separated as a variety. All students of the group are much indebted to Dr. Horn for working out the synonymy, from which it will be gathered that there is much variation in many points. This is one of the very few members of the genus that can, in any sense, be called common, so far as our knowledge goes at present, and an examination of a series leads us to think that some, at any rate, of the described species will hereafter be sunk as synonyms.

MADRAS: Mahé (*Maindron*); BENGAL: Rajmahal (*Annandale*), Calcutta; KASHMIR; NEPAL; ASSAM: North Cachar; BURMA: Bhamo, Tharawaddy, &c.; SOUTH CHINA; TONKIN; SIAM; COCHIN CHINA; MALAY STATES: Malacca, Singapore; SUMATRA; JAVA; BALI; SUMBAWA; SUMBA; NIAS IS.; BANGAY IS.

Var. diversipes, nom. nov.

This variety differs from the type-form in having the posterior tarsi red, and the forehead less excavate; the trochanters and the apex of the posterior tibiæ are sometimes of the same reddish colour. The insect closely resembles *N. cruentata*, Schm.-Goeb., to which Dr. Horn at first assigned it as a variety.

Length 13½–14½ millim.

BURMA; JAVA; BORNEO.

I suggest the name var. *diversipes* for this insect, as Dr. Horn's name var. *cruentata* is already preoccupied in the genus.

There are other varieties of this species which occur in South China and the Malay Archipelago, but they have not hitherto been found in India.

21. **Neocollyris distincta,** *Chaud.*

Collyris distincta, Chaudoir, Bull. Soc. Moscou, 1860, p. 290; id., Ann. Soc. Ent. France, 1864, p. 501.

Collyris procera, Chaudoir, Ann. Soc. Ent. France, 1864, p. 501; W. Horn, Deutsche Ent. Zeitschr. 1898, p. 193.

Variable both in size and colour, being blue, green, or violaceous; head rather long and broad, rounded behind the eyes, considerably more narrowed in the male than in the female, rather deeply excavate, with the space between the sulci not much raised; antennæ dark with the central joints more or less ferruginous; pronotum long and rather slender, rather strongly constricted at the base, with the intermediate part not strongly dilated and passing imperceptibly into a short pronotal collum, upper surface with scattered punctures, under surface punctured and pilose; elytra long, parallel-sided, cylindrical, closely and finely punctured throughout, with only slight traces of rugosity in the middle; legs slender and elongate, red, with the tibiæ and tarsi more or less impunctate; mesosternum smooth, except at the posterior angles which are punctured.

Length 13–15 millim.

BOMBAY: Kanara; BENGAL: Calcutta; SIKKIM: Darjiling; ASSAM: Khasi Hills; MADRAS: Chatrapur, Ganjam District.

In shape this species resembles *N. saphyrina*, but it is smaller and may be at once known by the much more fine and less rugose sculpture of the elytra.

Collyris procera, Chaud., is a variety of this species, with the forehead and vertex rather broader, the shoulders more plainly marked and the elytra without elongate punctures towards apex (*v.* W. Horn, D. E. Z. 1898, p. 193).

It is possible that one or two of the above localities may be in error, as Dr. Horn (Annotated List, pt. i, p. 3) says that, prior to the species being found at Calcutta, there was no record of its occurrence in Northern India. It occurs up to the extreme north-west of British India, but is not known from Ceylon.

Dr. Horn appears now to consider this insect as a variety of *N. bonelli*, but I prefer to leave it at present as a species.

22. **Neocollyris mœsta**, *Schm.-Goeb.*

Collyris mœsta, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 14; Chaudoir. Ann. Soc. Ent. France, 1864, p. 505.
Collyris flavicornis, Chaudoir, Bull. Soc. Moscou, 1860, ii, p. 292: id., Ann. Soc. Ent. France, 1864, p. 512, pl. 8, fig. 11.

This species is allied to the var. *ortygia* of *N. bonelli*, which it resembles in several points. The colour is dark cyaneous or violaceous with the head and pronotum sometimes almost black; the head is narrow, with the eyes not strongly prominent and the forehead not deeply excavate; the labrum has the central tooth the narrowest, the next on each side being much broader and rounded, the third pair sharp, projecting and separated from the adjacent pair by a broad notch, the fourth pair sharp and standing some little way back from the rest; the antennæ are long and not thickened; the pronotum is not strongly strangulate at the base and has the dilated portion in front of the base more slender, longer, and more parallel-sided than in *C. bonelli* var. *ortygia*, the pronotal collum being distinct, short, and parallel-sided; the upper surface is remotely punctured and slightly rugose (but this perhaps is variable); the elytra are a little broader behind, with the general outline somewhat rounded (the shoulders being obliquely rounded), strongly punctured, less closely at the base, closely and rugosely in the centre, the sculpture becoming much finer at the apex; a red line is sometimes present behind the shoulders, and also a transverse indistinct rufous band in the middle; the femora are red, the tibiæ dark cyaneous, and the posterior tarsi testaceous.

Length 13–15 millim.

Burma; Perak; Siam; Cambodia; Cochin China; Malacca.

23. Neocollyris cylindripennis, *Chaud.*

Collyris cylindripennis, Chaudoir, Rev. Mag. Zool. 1864, p. 106; id., Ann. Soc. Ent. France, 1864, p. 514, pl. 8, fig. 13.

One of the most distinct of all the species; elongate, bronze or pitchy bronze; labrum large, with broad blunt teeth; head long, moderately excavate between the eyes, sulci not strongly marked, vertex long, smooth, and shining; antennæ long, slightly thickened towards the apex, pitchy, central joints ringed with red; pronotum not strongly constricted before the base, the portion before the constriction being cylindrical and parallel-sided, and distinctly but obtusely angled before the pronotal collum, which is not very long but very distinct and parallel-sided, anterior margin reflexed, upper surface with large obscure scattered punctures, under surface punctured and pilose: elytra long, with a more or less coppery reflection, greenish towards the base, with a very distinct testaceous band at middle, and in most cases a fine reddish lateral line extending from the shoulders, strongly punctured throughout, the punctuation in the centre being rugose, and at the apex finer and longitudinally rugose; metasternum almost impunctate, except in the middle; legs slender, reddish, ferruginous, or pitchy, the posterior tarsi (except the claws) and the apex of the posterior tibiæ being whitish testaceous.

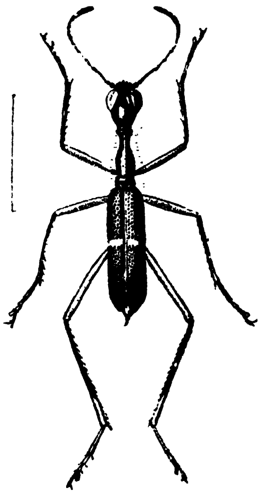

Fig. 109.
Neocollyris cylindripennis.

Length 15–16 millim.

Burma: Karen Hills (*Fea*); Siam.

24. Neocollyris cruentata, *Schm.-Goeb.*

Collyris cruentata, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 14; Chaudoir, Ann. Soc. Ent. France, 1864, p. 505.

Variable in colour, elytra cyaneous, or greenish cyaneous, or violaceous, or brownish with a violaceous reflection, front parts dark, shining, with a greenish or violaceous tinge; head rather large, not strongly narrowed behind, with the eyes rather prominent, forehead deeply excavate between the eyes with strong frontal sulci; antennæ pitchy, ferruginous in the middle; pronotum long, deeply impressed and constricted at the base, rather strongly dilated before the base, pronotal collum short and not abrupt, apical margin strongly reflexed, underside pilose, and with scattered punctures; elytra parallel-sided, deeply and closely punctured, the punctuation being somewhat rugose in the middle, and more elongate and less marked at apex; a dark red stripe behind the shoulders and a short irregular reddish patch at about the middle are sometimes present, but these are often quite obsolete; femora mostly red, tibiæ dark, tarsi dark, except the posterior pair, which are light yellow, except the last joint and the claws; metasternum plainly punctured; apophysal processes of female consisting of two parallel points proceeding directly from the apex of the last ventral segment.

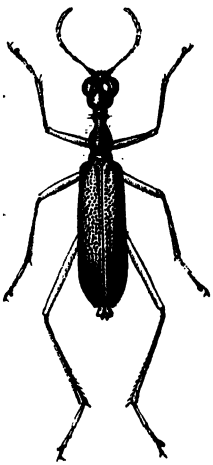

Fig. 110.
Neocollyris cruentata.

Length 14–15 millim.

ASSAM: Sibsagar (*Peal*); BURMA: Tharawaddy, Taung-ngu, Rangoon, Karen Hills, Pegu; TENASSERIM (*Wood-Mason*); SIAM: MALACCA; SUMATRA; BORNEO.

This species resembles *N. bonelli*, but is larger and may be known by its more deeply excavate forehead, more prominent eyes, less slender thorax, more deeply and rugosely punctured elytra, and the pale colour of the posterior tarsi; the latter character will at once superficially distinguish it from the above-named species, as well as from *N. rufipalpis*, to which it is also closely allied; the latter species, moreover, has the elytra more closely punctured and without the distinct elongate punctures at the apex.

25. **Neocollyris lesnei**, *W. Horn.*

Collyris lesnei, W. Horn, Ann. Mus. Genova. 1893, p. 374.

Elongate, rather narrow, with the front parts cyaneous and the elytra blue with a violaceous or greenish reflection; labrum large and smooth, with the five central teeth even and blunt, and two sharper ones lying further back; head broad, with prominent eyes, narrower behind in the male, with the front broadly excavate, the frontal sulci being deep and more or less approximate behind, and the space between only slightly convex; pronotum strongly constricted at the base, then dilated and rounded and gradually narrowed into a short pronotal collum, the apex rather

strongly reflexed, the upper surface almost smooth; elytra rather strongly, closely, and evenly punctured, much as in *N. rufipalpis*, Chaud., with only slight traces of rugose sculpture, apex comparatively smooth, apical margin truncate with the external angle sharp; the antennæ have the first and second joints and the base of the third cyaneous, the rest being entirely yellowish red; legs with the femora and trochanters red, the rest dark; all the sterna plainly punctured.

Length 13–14 millim.

BURMA: Karen Hills.

26. **Neocollyris similis**, *Lesne*.

Collyris similis, Lesne, Bull. Soc. Ent. France, 1891, p. 55; id., op. cit. 1895, p. 292, fig. 2.

Allied to *C. lesnei*, from which it differs in having the elytra more parallel-sided, giving it a somewhat more linear appearance, the pronotum a little more rounded before the basal constriction, and the pronotal collum slightly more marked; the antennæ are mostly dark and the projections or teeth of the last abdominal segment of the female are smaller; the metasternum is less strongly punctured: the punctuation of the elytra is somewhat coarser and shows rather more traces of rugosity.

Length 13–14 millim.

MADRAS: Nilgiri Hills; ASSAM: PERAK.

Both this and the preceding species may be easily known from *C. bonelli* and its var. *ortygia*, which they superficially resemble, by the shape of the head, which is much more widely and deeply excavate, much more constricted behind, and has the eyes considerably more prominent.

I am much obliged to Dr. Horn for sending me for inspection typical examples of this and the preceding species.

In the Deutsche Ent. Zeit. 1904, p. 83, Dr. Horn publishes further differences between *N. similis* and *N. lesnei*. The former of these, he says, has a less triangular head, and the pronotum is less conical (with the sides more rounded), tapering and somewhat broader in front; the difference of breadth is especially noticeable on the middle third; the short projecting processes at the apex of the last abdominal segment of the female are of the same general character in both species, but in *N. similis* they are less divergent and their whole conformation is narrower.

27. **Neocollyris rufipalpis**, *Chaud*.

Collyris rufipalpis, Chaudoir, Ann. Soc. Ent. France, 1864, p. 504; W. Horn, Deutsche Ent. Zeitschr. 1892, p. 357; id., op. cit. 1897, p. 50; id., Ann. Mus. Genova, 1893, p. 374.

Collyris obscura, Lesne, Bull. Soc. Ent. France, 1891, p. 55; id., op. cit. 1895, p. 292, fig. 1.

Very variable in colour, blue, cyaneous, or bright green, with or without a reddish band in the centre of the elytra and a longitudinal line of the same colour behind the shoulders; head rather large, slightly more narrowed behind in the male than in the female, frontal excavation rather large, frontal sulci deep and convergent behind; antennæ variable in colour; palpi in the male entirely rufous yellow, in the female pitchy black, first joint of the labial palpi yellowish; pronotum rather strongly constricted at the base, conical before the base, with the sides not strongly rounded and passing gradually into a short pronotal collum, upper surface almost smooth, very finely and in some specimens almost imperceptibly strigose, under surface punctured and pilose; elytra subparallel-sided, very closely, evenly, and deeply punctured, with traces of rugosity towards the suture in and behind the middle, interstices raised; femora clear red, tibiæ and tarsi dark; metasternum distinctly punctured; apophysal processes of the last ventral segment of the female blunt, curved, and divergent.

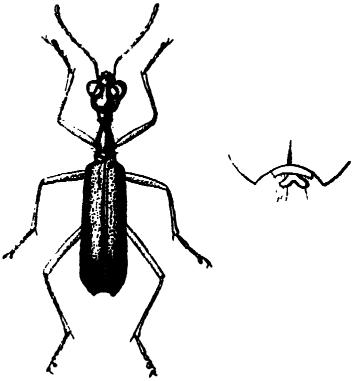

Fig. 111.—*Neocollyris rufipalpis*, and apophysal processes of female.

This species is smaller than *N. saphyrina*, and may be known at once by its much finer punctuation; from *N. distincta* it may be separated by its wider pronotum, more strongly marked shoulders of the elytra, and rather coarser punctuation; and from *N. fuscitarsis*, apart from various differences of form and punctuation, by the colour of the legs.

Length 13½–15 millim.

ASSAM; BURMA: Karen Hills; COCHIN CHINA; TONKIN; SUMATRA; JAVA.

Apparently *N. obscura*, Lesne, is merely a dark coloured variety.

28. **Neocollyris cylindrica**, *Schm.-Goeb.*

Collyris cylindrica, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 15; W. Horn, Deutsche Ent. Zeitschr. 1899, p. 131.

Cyaneous; moderately broad, parallel-sided and cylindrical head moderately broad, deeply excavate, with distinct frontal furrows; antennæ short, scarcely reaching the middle of the pronotum, scarcely thickened towards the apex, with the first three joints blue, the next two partly blue, and the rest red; pronotum feebly constricted at the base and gradually narrowed until just before the apex, finely strigose transversely; elytra coarsely and not closely punctured, rugose in the middle, finely and longitudinally punctured at the apex; legs red or yellowish red, with the anterior and intermediate tibiæ and tarsi cyaneous, and the last two joints of the posterior tarsi black-brown.

Length 14 millim.

BURMA.

29. **Neocollyris fuscitarsis**, *Schm.-Goeb.*

Collyris fuscitarsis, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 16; Chaudoir, Ann. Soc. Ent. France, 1864, p. 499.
Collyris diffracta, Schm.-Goeb., op. cit. p. 17.

Blue, violaceous, purplish, or green, but usually blue; head large, vertex not strongly narrowed behind the eyes, which are prominent, frontal excavation deep, the space between the sulci not very convex, labrum large; antennæ dark at the base, the rest reddish yellow; pronotum moderately constricted at the base, and strongly so before the apex, the intermediate portion being gradually but not strongly widened from the base towards the apex, before which it forms a very short pronotal collum (in a large series, however, such as I have before me, this character slightly varies), upper surface with more or less distinct rugose striation, under surface somewhat remotely but plainly punctured, and pilose: elytra strongly and coarsely punctured, the punctures being larger and rugose in the middle, and much finer towards the base, the apex being almost smooth; legs bright red, the anterior and intermediate tarsi, and the apical joint of the posterior pair being fuscous; metasternum very finely, but distinctly punctured.

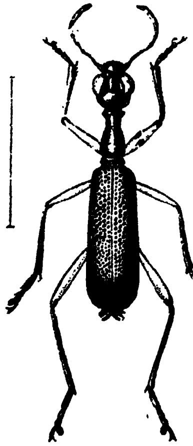

Fig. 112.
Neocollyris fuscitarsis.

Length 15–18 millim.

SIKKIM; ASSAM; BURMA: Moulmein, Rangoon, Tharawaddy; COCHIN CHINA; TONKIN; MALACCA; SUMATRA; JAVA.

Schmidt-Goebel (*l. c.* p. 16) says that Helfer, in his Journal, has the following note on this species:—

"The colour of the legs, which is very constant, will distinguish this species from its nearest allies; it is very variable in size, colour, and also, to a certain extent, in the shape of the pronotum and in the sculpture of the elytra."

30. **Neocollyris saphyrina**, *Chaud.*

Collyris saphyrina, Chaudoir, Bull. Soc. Moscou, 1850, p. 18; id., Ann. Soc. Ent. France, 1864, p. 498, pl. 7, fig. 5.
♀ *Collyris boysii*, Chaudoir, op. cit. 1860, p. 288.

Allied to *N. fuscitarsis*, from which it may be known by its average larger size, the much stronger and more rugose punctuation of the elytra, the dark tibiæ, and the more slender pronotum which has a longer collum, and has hardly any traces of rugose striæ; the antennæ are dark at the base, with the central joints dark and ringed distinctly with red, and the apical joints fuscous or reddish fuscous; the sterna are very finely punctured.

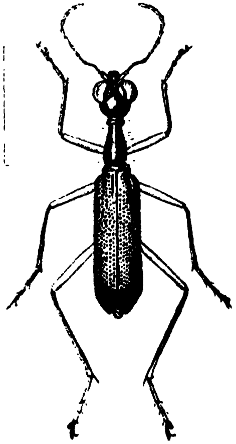

Fig. 113.—*Neocollyris saphyrina.*

The female differs from the male in having the antennæ somewhat shorter, the head less narrowed behind, the eyes less prominent, and the thorax a little broader; it was described at first by Chaudoir as another species; the differences are not striking.

Length 17–18 millim.

Nepal; Sikkim: Pedong, Mungphu; Assam.

31. Neocollyris insignis, *Chaud.*

Collyris insignis, Chaudoir, Rev. Mag. Zool. 1864, p. 76; id., Ann. Soc. Ent. France, 1864, p. 496, pl. 7, fig. 4.

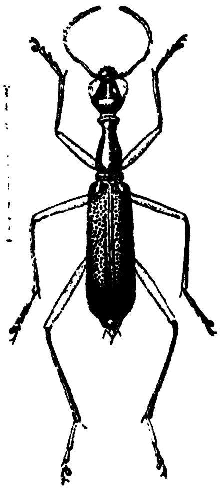

Fig. 114.
Neocollyris insignis.

Very closely allied to *N. saphyrina,* but on the average larger, with the head a little less quadrate in the male (in the female the difference is not marked), the pronotum slightly narrower and more elongate, and distinctly less constricted at the base, the basal angles being considerably more in a line with the sides than in *N. saphyrina*; the sculpture of the elytra is stronger, and the central plicæ are larger and more marked; in some specimens there are distinct traces of rugose striæ on the upper surface of the pronotum, but in others the upper surface is quite smooth as in the specimens of *N. saphyrina* which I have seen; this is apparently a variable character in this group, for Chaudoir, in describing *N. saphyrina,* says: "thorax supra obsolete striolatus." The punctures on the prosternum are feeble and remote, while those on the metasternum are very close and fine.

Length 18-21 millim.

SIKKIM: Darjiling, Mungphu, Pankabari; BHUTAN; ASSAM: Khasi Hills; BURMA.

32. Neocollyris smaragdina, *W. Horn.*

Collyris smaragdina, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 220.

Allied to *N. insignis,* from which it may be known by its smaller size and narrower shape, and by the strongly narrowed head, which has the eyes less prominent, and the forehead less broadly but more deeply excavate; the pronotum is narrower with the collum longer and the anterior margin much less reflexed, and the elytra are more slender with the punctures on the anterior half less deep and a little less close towards the base; the head and pronotum are cyaneous and the elytra greenish, and there is a pitchy-black or brownish patch on the anterior half towards the suture; the anterior legs are cyaneous or black; the antennæ and the rest of the legs are wanting in the specimen described by Dr. Horn.

Length 17 millim.

SIKKIM: Mungphu, Kurseong; BHUTAN.

33. Neocollyris crassicollis, *Chaud.*

Collyris crassicollis, Chaudoir, Ann. Soc. Ent. France, 1864, p. 497.

Allied to *N. saphyrina*, and, apparently, closely resembling that species, from which it is chiefly distinguished by the shape of the pronotum, which is of the same length, but much larger in its dilated part and much less contracted in front, with the basal constriction less marked especially at the sides; on the elytra there are only two or three plicæ in the centre, and at the apex of one of these is sometimes a yellow spot; the antennæ, after the first two joints, are reddish, gradually becoming darker towards the apex. Compared with *N. insignis* it has the pronotum shorter, thicker, and less contracted in front, and the plicæ of the elytra and the sculpture near these more feeble.

Length 17 millim.

SIKKIM.

The type, which Chaudoir refers to (*l. c.* p. 497) as being in the British Museum, is missing, as Dr. Horn has also pointed out, and I have not been able to see an example of the species.

34. Neocollyris saundersi, *Chaud.*

Collyris saundersi, Chaudoir, Ann. Soc. Ent. France, 1864, p. 496.
N. saundersi, var. *lætior*, W. Horn, Spolia Zeylan. ii (5), 1904, p. 35.
N. saundersi, var. *continentalis*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 295.

A very distinct species; black, with a more or less distinct bronze or greenish bronze reflection; head large and broad in the female with the vertex subquadrate and dilated at the base; male with the sides contracted gradually before the base; antennæ longer in the male than in the female, dark, reddish brown towards the apex (at least in some specimens); frontal excavation large, frontal sulci strong, the space between them flat; pronotum long and slender, not strongly constricted before the base, then slightly dilated and gradually passing into a rather long pronotal collum, upper surface plainly and more or less strongly strigose, underside also strigose; elytra very strongly and deeply punctured, scarcely, if at all, rugose in the middle, the sculpture being finer towards the base and apex, but distinct throughout; apex truncated, more widely so in the female than in the male; legs dark, with the femora and coxæ red; metasternum very finely punctured at the sides.

Length 14–17 millim.

CEYLON: Kandy, Bandarawela.

Var. lætior, *W. Horn.*

Rather smaller, on the average, than the type; colour above and below subolivaceous, with the head black; femora and coxæ rufous brown; tibiæ either cyaneous or rufo-testaceous; tarsi entirely cyaneous, or with the first joint of the intermediate and posterior pairs brownish; pronotal collum less abrupt and a little stouter.

Length 13–16 millim.

CEYLON: Colombo, Morawak, Korale, Kandy.

Var. **continentalis**, *W. Horn.*

This variety differs from the type in having the central part of the forehead narrower, with the orbits striolate; the pronotum is a little shorter and thicker (the anterior collum being plainly shorter and less narrowed), much less striated on its upper surface (the hinder part of the disc being almost smooth), and with the base more strongly strangulate at the sides; the sculpture of the elytra before the apex is a little more confluent longitudinally; the episterna of the prosternum are less transversely striated, and, together with the episterna of the mesosternum, are more scantily and coarsely punctured; the sculpture of the metasternum, the posterior coxæ and the abdomen is closer and in part coarser, and the lateral anterior angle of the metasternum is punctured; the colour of the body is olive-bronze with the femora red.

From the var. *lætior* it differs in the somewhat narrower central portion of the forehead and the evidently striated orbits of the eyes, the shorter and smoother pronotum which is more thickened behind, the finer sculpture of the elytra and the more pronounced longitudinal sculpture at the apex, the coarser punctuation of the pro- and mesosternum, and the thicker sculpture of the metasternum and the posterior coxæ.

Length 16–17 millim. (15 mm. sine labro).

MADRAS: Wallardi in Travancore (*Maindron*).

35. **Neocollyris nilgirica**, sp. n.

A slender and graceful species, of a greenish bronze colour, with long legs and long filiform antennæ which are not thickened towards the apex; labrum large with the centre testaceous, palpi black; head rather large, with very large rotundate eyes which are moderately prominent, the space between the eyes broad and deeply depressed, with a fovea in the centre of the depression and with the supra-orbital striæ not strongly marked, the vertex long behind the eyes with the surface smooth but with traces of transverse striæ, genæ rounded; pronotum long, slender, moderately dilated behind, strongly sulcate before the base, and gradually narrowed in front into a rather long and slender neck which is somewhat widened and reflexed in front; the whole surface is transversely striate and on each side there is distinct long scanty whitish pubescence; elytra long and comparatively narrow, with the shoulders not marked, of a more distinct greenish bronze colour than the front parts, with a yellowish transverse patch on each about middle reaching from the margins towards the suture, distinctly and fairly evenly punctured throughout, the punctures being slightly rugose about the middle; legs very long and slender, metallic, with the knees and basal portion of the femora brownish or brownish testaceous, and the trochanters lighter testaceous; underside dark, smooth and shining, with the abdominal segments very finely punctured and duller towards the apex or in the centre.

Length 14½ millim.

MADRAS: Nilgiri Hills (*H. Leslie Andrewes*).

This is a very pretty and elegant species; in general structure and shape of pronotum it resembles *N. saundersi*, from which it may be at once known by its very much finer sculpture; from *N. arnoldi*, and allied species, it may be distinguished by its less prominent eyes and the distinct transverse striation of the pronotum.

36. Neocollyris crassicornis, *Dej.*

Collyris crassicornis, Dejean, Spec. Gen. i, 1825, p. 166; Schmidt-Goebel, Faun. Col. Birm. 1846, p. 12; Chaudoir, Ann. Soc. Ent. France, 1864, p. 494, pl. 7, fig. 2.
Collyris pleuritica, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 13.
Collyris vollenhovii, Chaudoir, op. cit. p. 495.

Variable in colour, blue, violaceous, bright green, cyaneous black or black; antennæ dark, considerably thickened towards the apex; head large, vertex subquadrate, smooth and convex, sides a little more contracted behind in the male, frontal excavation deep, slightly convex in the middle, the intermediate space bounded by two deep sulci, and a very distinct transverse impression behind; pronotum strongly constricted at the base, and then more or less strongly dilated, the dilated part passing off more or less abruptly into a distinct pronotal collum, upper surface more or less distinctly strigose, under surface remotely punctured; elytra very strongly punctured, more closely and rugosely in the middle, with elongate punctures behind; tibiæ and tarsi dark, femora, except apex, red; meso- and metasternum finely punctured; apophysal processes in female sharp and scarcely divergent.

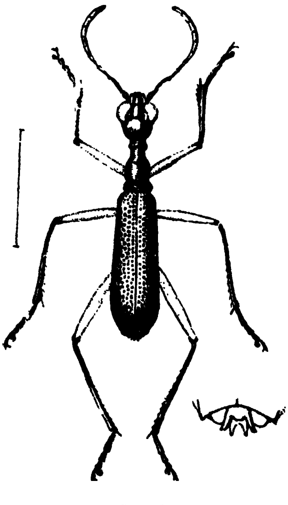

Fig. 115.—*Neocollyris crassicornis*, with apophysal processes of female.

Length 15–18 millim.

Apparently widely spread over the greater part of CONTINENTAL INDIA; CEYLON; MADRAS: Anaimalai Hills, Gopduka Island, Chilka Lake, Ganjam District; BENGAL: Calcutta, Ranchi, Maldah, Chota Nagpur; ASSAM: Sibsagar; BURMA; SIAM; CHINA; MALAY PENINSULA; SUMATRA; JAVA.

This is one of the very few species of *Collyris* that can be termed common and its variability, as in the case of *C. bonelli* var. *ortygia*, tends to show that care should be taken in describing new species. Not only is the colour variable, but the structure also to a certain extent; in some specimens I have before me the dilated portion of the pronotum is almost spherical, and the front of the dilatation presents traces of distinct angles before the constriction; in others the pronotum is much less thickened and the pronotal collum is less abrupt. These specimens appear to be intermediate between *N. crassicornis* and *N. subclavata*, and I can see no real specific difference between these two species.

Mr. Robinson (Fasc. Malayenses, i, Oct. 1903, p. 182) speaks of this insect as "running on leaves and shrubs, and flying rapidly from shrub to shrub."

"This species appears to inhabit jungle less dense than that to which most of its congeners are restricted. In the environs of Calcutta it is found not uncommonly in uncultivated spots in which shrubs and high herbage have grown up." (*Annandale.*)

37. **Neocollyris subclavata,** *Chaud.*

Collyris subclavata, Chaudoir, Bull. Soc. Moscou, 1860, p. 289; id., Ann. Soc. Ent. France, 1864, p. 495, pl. 7, fig. 3.
Var. *Collyris andamana*, Bates, Cist. Ent. ii, 1878, p. 335.

Nearly allied to *N. crassicornis*, to the more slenderly built specimens of which species it bears a close resemblance; the antennæ are somewhat longer, the head a little less rounded, and the eyes somewhat more prominent, according to Chaudoir, but these differences are small and sexual; the pronotum is, however, decidedly more slender than in the ordinary specimens of *N. crassicornis*, the pronotal collum is longer, and the elytra are rather narrower, and more elongate and parallel-sided.

Length 16-17 millim.

MADRAS: Nilgiri Hills; BENGAL CHINA.

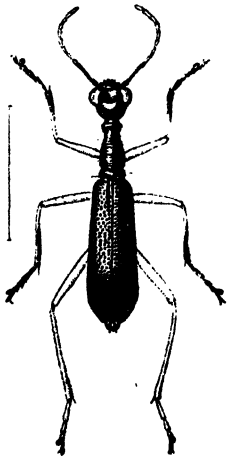

Fig. 116.—*Neocollyris subclavata* var. *andamana*.

Var. **andamana,** *Bates.*

Larger than the type, of a deep blue or violaceous colour, with the pronotum more dilated before the pronotal collum, and the punctuation of the central portion of the elytra more rugose, with the interstices more raised. Bates compares the species with *C. crassicornis*, and gives as characters distinguishing it from that species, the less dilated and more conical intermediate portion of the pronotum, the more strongly strigose upper surface of the same, and the longer and more slender fifth joint of the antennæ. The specimens I have seen appear to be more closely related to *N. crassicornis* than to *N. subclavata*, but the two last-mentioned insects ought probably to be referred to one species.

Length 16–19 millim.

ANDAMAN ISLANDS.

38. **Neocollyris orichalcina**, *W. Horn.*

Collyris orichalcina, W. Horn, Deutsche Ent. Zeitschr. 1896, p. 149.

Bronze-black, with a more or less strong coppery reflection on the elytra; head narrowly but deeply excavate, with the frontal sulci rather short, and the space between them only slightly raised, labrum gently rounded, vertex large and smooth, subquadrate, rounded behind the eyes; antennæ thickened, dark at the base, reddish towards the apex; pronotum almost smooth, with indistinct traces of transverse striæ, rather strongly constricted before the base, then gradually widened and conical, passing into a short and indistinct pronotal collum, anterior margin moderately strongly reflexed, underside very finely and remotely punctured; elytra subparallel-sided, with the shoulders strongly marked, rectangular, the punctuation in front moderately strong but scanty, in the middle very strong and rugose, with the interstices raised, behind the middle strong and close, towards apex finer; femora red, anterior and intermediate tibiæ and tarsi dark, apex of the posterior tibiæ and the posterior tarsi, except the last joint, testaceous or reddish testaceous, the rest of the posterior tibiæ being dark or dark reddish: the colour, however, of the legs is somewhat obscure and variable; metasternum only punctured towards the posterior angle.

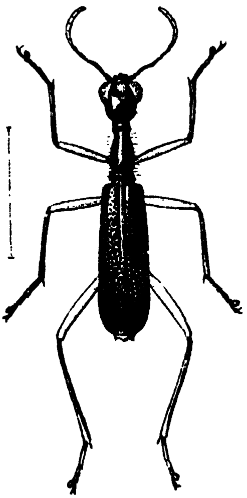

Fig. 117.
Neocollyris orichalcina.

Length 14–16 millim.

MADRAS: Nilgiri Hills (*H. L. Andrewes*); ASSAM: Naga Hills, N. Manipur, 3500–5000 ft.

The single specimen from the Nilgiri Hills, which has been kindly sent to me by Mr. H. E. Andrewes for inspection, is a cyaneous blue variety of this insect; superficially it has a very different appearance, but Dr. W. Horn regards it as merely a variety; its occurrence so far from the only other known locality is interesting.

39. **Neocollyris bipartita**, *Fleut.*

Collyris bipartita, Fleutiaux, Bull. Soc. Ent. France, 1897, p. 24; W. Horn, Deutsche Ent. Zeitschr. 1901, Beiheft, p. 57.

Elongate, enlarged behind, black, with the posterior part of the elytra reddish; antennæ black, with the intermediate joints ringed with red, feebly thickened at the apex; pronotum thicker and more convex than in *N. orichalcina*; elytra very coarsely punctured in the middle, more finely towards the base and apex, the punctures being distinct and elongate at the apex; legs red, with the base and apex of the femora and tibiæ, and the tarsi, dark.

Dr. Horn (*l. c.*) says that he has examined the single specimen on which M. Fleutiaux described this species, and that instead of being a male, 22 mm. in length, as stated in the description, it is a female of 16 mm.; it differs, he says, from all the species known to him in the very coarse sculpture of the elytra, which is less gradual than usual on the anterior sixth part; this coarse sculpture is continued to just before the middle; in the middle it becomes irregular and forms somewhat slight folds or plicæ; it is somewhat finer behind, but the longitudinal impressions on the posterior portion are very marked ("vor der Spitze ganz auffallend tiefe Längs-Eindrücke!")

"INDIA."

From *N. orichalcina* the species differs in its thicker thorax and less thickened antennæ, and from *N. feæ* by its less elongate form, flatter forehead between the eyes, much shorter pronotum (which therefore appears thicker behind), and above all by the more coarsely punctured elytra, which have the central plicæ fewer and less close.

There is a specimen in Fry's collection in the British Museum labelled "Karen Mts., Burmah" (*Doherty*), which I think must be referred to this species.

40. **Neocollyris feæ**, *W. Horn.*

Collyris feæ, W. Horn, Ann. Mus. Genova, 1893, p. 373.

A large species, cyaneous black, with the elytra more or less tinged with castaneous or reddish brown, the colour being usually lighter behind the middle; head large, subquadrate, with the frontal excavation between the parallel sulci deep and flat and carinate in front; antennæ rather long, dark at the base, joints 3 and 4 ringed with red, 5–11 rufo-testaceous; pronotum elongate, strongly constricted and impressed at the base, the intermediate dilated portion being parallel-sided, not broader than the base, and more or less distinctly angled externally before the rather short, but distinct, pronotal collum, the apex being reflexed and cup-shaped, upper surface almost smooth, underside with large scattered punctures; elytra subparallel-sided, or slightly dilated behind, with the shoulders angulate, anterior third very sparingly punctured, smooth and shining, intermediate third very strongly plicate, the interstices being much raised, posterior third with strong, more or less elongate, punctures, which become obsolete towards the apex; mesosternum smooth, except at the sides, which are distinctly punctured; metasternum very finely punctured; legs red, more or less pitchy, variable in colour, the posterior tarsi being red with the apical joint black.

Length 20–23 millim.

BURMA: Karen Hills.

The shape of the pronotum is somewhat variable, being sometimes more elongate and less dilated in the male.

41. Neocollyris smithi, *Chaud.*

Collyris smithi, Chaudoir, Ann. Soc. Ent. France, 1864, p. 518.
Collyris macleayi, W. Horn, Deutsche Ent. Zeitschr. 1895, p. 81.

Nigro-cyaneous, with the elytra castaneous at apex, and more or less at base; head large, with the frontal excavation somewhat more abrupt behind than in the preceding species; antennæ reddish brown, with the base cyaneous; pronotum not strongly constricted at base, very slightly widened at the sides (in this respect bearing much the relation to *N. feæ* that *N. insignis* bears to *N. saphyrina*), with the dilated portion gently rounded at the sides and constricted into a short collum, almost smooth, underside with very fine punctures; elytra with the shoulders well marked and angular, with very strong plicæ in the centre, occupying the central third, punctuation towards base and apex very scanty, and sometimes more or less obsolete; episterna of metasternum distinctly punctured over most of their surface, more strongly so at the sides; legs red, more or less pitchy.

Length 22–23 millim.

E. BENGAL: Dacca; ASSAM: Naga Hills; BURMA: Pegu District; also recorded doubtfully from TIBET.

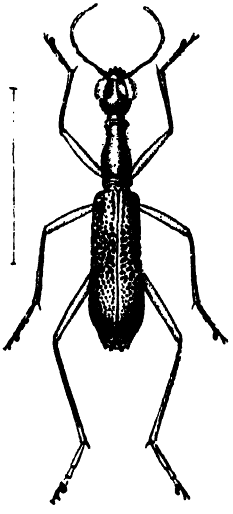

Fig. 118.
Neocollyris smithi.

The sculpture of the elytra and the metasternum will at once distinguish this species from *N. feæ*. In the specimens I have seen, the shape of the pronotum in these species is almost identical, except for the less constriction at the base in *N. smithi*.

42. **Neocollyris aptera**, *Lund.*

Cicindela aptera, Lund, Skrivt. Nat. Selsk. i, 1790, p. 65, pl. 6, fig. 1; Fabricius, Ent. Syst. i, 1792, p. 169; Chaudoir, Ann. Soc. Ent. France, 1864, p. 518, pl. 8, fig. 15.

Very closely allied to *N. smithi*, but easily known by its smaller size, narrower form, and more slender pronotum, which has the pronotal collum longer and much less abrupt, and shows more distinct traces of strigose sculpture; the elytra are cylindrical and parallel-sided, castaneous, with the central portion more or less dark, almost smooth towards base and apex, very strongly plicate, with a narrow bright reddish band just at the centre (often obsolete); episterna of metasternum distinctly punctured over the greater part of their surface; femora red, anterior and intermediate tibiæ black, posterior tibiæ black, testaceous at apex, tarsi (except apex) testaceous.

Length 19–20 millim.

ASSAM: Naga Hills, N. Manipur, Sylhet; TENASSERIM.

The punctation is somewhat variable, but the shape of the pronotum will easily distinguish it from the preceding species; the female specimen I have before me has the pronotum a little more dilated at the sides, the elytra less parallel, and the punctuation of the base and apex of the latter more distinct. The species is very rare apparently, and comparatively few specimens are known. The elytra are not connate, as stated by Fabricius, nor is the species wingless.

43. **Neocollyris apteroides**, *W. Horn.*

Neocollyris apteroides, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 59.

Allied to *N. aptera*, but with the head smaller, the eyes a little less prominent, the forehead narrower anteriorly between the sulci, the pronotum a little shorter, the anterior margin more declivous, and the posterior portion less conical and more abruptly constricted in front; the pronotum is longer and more slender than in *N. smithi*, and the elytra much as in that species, but with the central plicate portion more dilated, especially toward base, and less abruptly passing into scanty punctuation, the punctures before and behind the plicæ being larger; the metasternum is also more thickly and finely punctured. The antennæ are less thickened than in *N. orichalcina*, with which it agrees in the shape of the head, and the pronotum is longer and more slender, with a longer and narrower pronotal collum; the sculpture of the elytra, moreover, is different, being less close behind, with the punctures not elongate.

Length 20 millim.

ASSAM: Manipur (*Doherty*).

44. Neocollyris apicalis, *Chaud.*

Collyris apicalis, Chaudoir, Rev. Mag. Zool. 1864, p. 105; id., Ann. Soc. Ent. France, 1864, p. 517.

Elongate, narrow, subparallel-sided, and smaller than the preceding species, the female being larger and more widened than the male * ; colour variable, front parts cyaneous, with a violaceous or coppery reflection; elytra with the apical third castaneous or blackish cyaneous; pronotum very variable, narrow and slightly angled before the collum, or incrassate and abruptly angled, or simply rounded off and passing gently into the collum, upper surface smooth and shining; in the single female specimen I have before me the pronotum is distinctly wider than in the male; elytra sculptured much as in *N. aptera*; mesosternum very finely punctured over most of its surface; femora red; intermediate and posterior tibiæ and tarsi dark, posterior tibiæ and tarsi either nigro-cyaneous or rufescent.

Length 16–18 millim.

ASSAM: Patkai Hills; SOUTH BURMA; MALACCA; SUMATRA. The specimens I have seen are from Singapore.

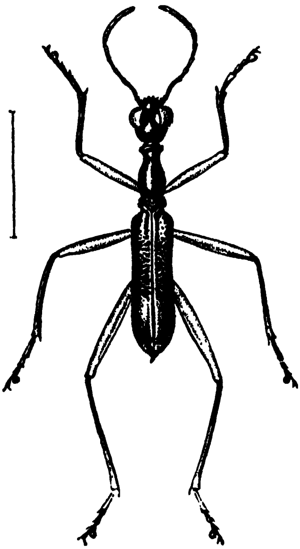

Fig. 119.—*Neocollyris apicalis.*

Apart from the size, the absence of striation on the pronotum, the somewhat different plication of the centre of the elytra, and the rather finer punctuation of the mesosternum, I can see very little difference between this species and *N. aptera*, and these differences are not marked, except the first. Chaudoir (Ann. Soc. Ent. France, 1864, p. 519) compares it with *Collyris tuberculata* (also a Malaccan species) with which it has very little in common, the latter being a dark cyaneous-blue species with the dilated portion of the pronotum much more cylindrical and angled, and the elytra strongly and closely punctured throughout, with strong elongate punctuation before apex. The variability of the pronotum in some of the species belonging to this section makes them hard to determine.

45. Neocollyris foveifrons, W. *Horn.*

Neocollyris foveifrons, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 60.

This species is closely allied to *N. apicalis*, from which it differs in having the labrum a little longer and the central teeth somewhat more produced; the head is shorter, with the vertex broader, and the frontal sulci not parallel, but converging behind; there is a very deep frontal fovea, and the front part of the forehead is distinctly carinate; the pronotum is a little more slender, with the frontal collum somewhat narrower, and the posterior part less parallel (in *N. apicalis*, however, this is very variable); the upper surface is smooth with faint traces of striation in front, the shoulders are a little more distinct, and the elytra have the plicate part much the same, but the anterior and posterior portions, especially at the sides, are less suddenly minutely punctured; the pronotum (except a central line and the base and apex), the episterna of the pro- and meso-sternum, the hinder part of the cheeks, and the whole of the elytra, except the impressed punctures and the anterior part of the suture, are more or less rufous; the posterior tibiæ are rufescent cyaneous, and the first three joints of the posterior tarsi testaceous; the metasternum is punctured in the centre, and sparingly at the lateral angles.

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* Chaudoir says: "Elytra maris paullo latiora," evidently in error.

Length 17 millim.

ASSAM: Khasi Hills.

I insert this species on Dr. Horn's authority, but, considering the variability of the group in several of the characters named, I think that it requires more confirmation.

46. Neocollyris sarawakensis, *Thoms.*

Collyris sarawakensis, Thomson, Arch. Ent. i, 1857, p. 133; Chaudoir, Ann. Soc. Ent. France, 1864, p. 531, pl. 9, fig. 22.

Var. *Collyris dohertyi*, W. Horn, Deutsche Ent. Zeitschr. 1895, p. 83.

An elongate, parallel-sided, and rather slightly built species (male more slender than female), of a brownish black or deep castaneous brown colour, or with more or less cyaneous reflection; head long, with the eyes large and prominent; antennæ dark, long; labrum rather small, semicircular, with strong teeth, forehead depressed between the eyes, with the intermediate space flat, carinate in front between the short frontal sulci, which reach to about the middle of the eyes, the sides between the eyes with strongly raised strigæ; vertex short behind eyes; pronotum long and slender, not strongly impressed at base, conico-cylindrical, with the pronotal collum occupying almost half the length, upper surface, as a rule, strongly and always distinctly strigose transversely, underside feebly punctured, almost smooth or with traces of striæ; elytra feebly punctured at base for about one-sixth of their length, as a rule feebly punctured or almost smooth for the posterior third, and the rest strongly plicate; the space covered by the plication, however, is very variable, and in some specimens hardly occupies more than a quarter of the whole; the punctuation, also, of the anterior part is sometimes strong, though always scattered; metasternum strongly pilose, feebly and very closely sculptured; femora, except apex, red; anterior and intermediate tibiæ dark, posterior tibiæ dark, with the apex more or less broadly whitish testaceous; tarsi, except claws, whitish testaceous.

Length 16–18 millim.

ASSAM: Sylhet; SUMATRA; MALACCA; BORNEO.

I have introduced this species into the Indian fauna on the authority of a single female specimen labelled "Sylhet" in Mr. B. C. Nevinson's collection (now in the British Museum), which agrees exactly with typical specimens of *N. sarawakensis*, except that the apex of the posterior tibiæ is not so strongly coloured, and the base is slightly more widened. It appears to me to be intermediate between *N. sarawakensis* and *N. dohertyi*, as the plicæ are continued almost to the base near the suture, but the extreme base and the sides of the posterior third are feebly punctured. Dr. W. Horn thinks that a mistake has been made as to the locality; there is a single specimen (donor unknown) labelled "Assam" in the Indian Museum collection.

Var. **dohertyi**, *W. Horn*.

Differs from the type chiefly in having the basal third part of the elytra not obsoletely punctured, but rugosely plicate, and the base itself coarsely and thickly punctured; the trochanters and the base of the femora are rufous yellow, and the palpi yellow or brown with a greenish reflection. This variety is also related to *N. leucodactyla*, Chaud., var. *discolor*, Chaud., from which it may be known, apart from colour and sculpture, by the fact that the pronotal collum is more distinct and the upper surface more plainly striate transversely.

Length 17½–18½ millim.

BURMA; SUMATRA; SIAM; MALACCA.

Dr. Horn (*l. c.* p. 84) says that he was for long in doubt whether to regard this insect as a species or a variety, and it may be wrong to join it to *N. sarawakensis*, but, in view of the great variability of the last-named species, it appears better to wait for further specimens before separating them.

47. **Neocollyris rubens**, *Bates*.

Collyris rubens, Bates, Cist. Ent. ii, 1878, p. 336.

"Allied to *C. sarawakensis*, Thoms., which it resembles. Castaneous red, with the antennæ, head, breast, tibiæ, and tarsi nigro-æneous; head before the eyes widely excavate, with the frontal furrows short and scarcely incised, the space between narrowly convex; thorax conical behind, strigose, constricted before the middle, then convex before the apex, swollen; elytra sparingly and coarsely punctured at base and apex, in the centre very coarsely rugose transversely, and on this part tinged with cyaneous."

Length 8½ lin. [17 millim.].

"♂. With the posterior tibiæ at the apex and the tarsi fulvous.

"ASSAM (plains)."

Type in M. Oberthür's collection.

Dr. W. Horn informs me that he has been unable to see the species, but that this is certainly its proper position.

48. **Neocollyris plicaticollis**, *Chaud.*

Collyris plicaticollis, Chaudoir, Ann. Soc. Ent. France, 1864, p. 534.

Smaller than the average specimens of *N. andrewesi*, to which species it bears a superficial resemblance; head rather long, with the vertex short, narrowed at the base, eyes large and prominent, frontal excavation deep and narrow, with deep sulci, the space between them scarcely raised; antennæ dark, with the basal joints clear red, and the 3rd and 4th joints red at the apex; pronotum long and slender, very strongly strigose transversely, feebly constricted at the base and very gradually passing into a rather long pronotal collum, the underside feebly and remotely punctured at the sides, and more or less strigose, with rather strong pilosity; elytra very strongly and rugosely punctured throughout, the punctuation being only a little less strong at the apex; femora red, tibiæ and tarsi dark; metasternum smooth, impunctate.

Length 17½ millim.

CEYLON.

Type in the British Museum.

This species may easily be known from *N. andrewesi* by the shape of the head, which has the vertex much narrower and shorter, and the frontal excavation much narrower and not striate at the base of the eyes; and also by the coarser punctuation of the elytra and the smooth metasternum. These last two characters will also separate it from *N. horsfieldi*, to which it appears to be most nearly related; the latter species also has the frontal excavation broader and plainly striate behind the eyes at the base.

49. **Neocollyris andrewesi**, *W. Horn.*

Collyris andrewesi, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 170.

A large and distinct species, with the female a little wider than the male; head large, subquadrate, eyes moderately prominent, forehead broadly impressed, with the sulci not deep, and the space between them slightly raised in the middle, sharply carinate in front (but not in all specimens), the vertex rather dilated at the sides, the same in both sexes; antennæ long and slender, dark, middle joints ringed with red; front parts dark with a greenish or slightly coppery reflection, or cyaneous; elytra dull, dark olivaceous; pronotum long, slender, scarcely at all constricted at the sides, and feebly impressed above at the base, passing gradually but plainly into a distinct pronotal collum, which occupies about one-third of the length, upper surface rather strongly transversely strigose, underside distinctly, though remotely, punctured and pilose; elytra with the shoulders strongly marked, raised, elytra strongly, evenly, and closely punctured throughout, the punctures being more or less rugose at and before the middle and finer at the apex; metasternum pilose, very finely and closely punctured, except in the middle; femora red, anterior and intermediate tibiæ and tarsi cyaneous, posterior tibiæ cyaneous with the apex reddish yellow, tarsi, except apex of joints and the claws, flavous.

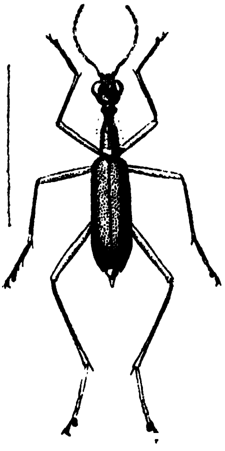
Fig. 120.
Neocollyris andrewesi.

Length 19–24 millim.

MADRAS: Trivandrum, Travancore, Nilgiri Hills and Anaimalai Hills (*Andrewes*); BOMBAY: North Kanara (*Bell*). Recorded doubtfully from Ceylon. Mr. Bell says:—"Very common in June and throughout the rains on the Ghats, perching and hunting on trees only." Mr. H. Leslie Andrewes says:—"(1) Anaimalais, May, 3000–4000 ft.; (2) Nilgiris, May, June, July, August, 3000–4000 ft. On herbage. Takes flight very readily. Ouchterlony Valley."

This species is allied to *N. horsfieldi*, a rather common Javanese species, but the latter is smaller, with the eyes more prominent, and the space between them strongly strigose at the sides; the vertex, too, is plainly more contracted behind, and the pronotal collum is evidently more abrupt.

As the types of the two following species are unique and I have not been able to see them, and as both the authors (Chaudoir and W. Horn) have described them by comparison with *N. arnoldi*, it may be well to give a description of this somewhat common Javanese species, which is one of the prettiest and most elegant members of the genus:—

[*N. arnoldi*, McLeay, Ann. Jav. i, 1825, p. 10; Chaudoir, Ann. Soc. Ent. France, 1864, p. 528, pl. 9, fig. 20.

An elongate slender and graceful species, of a lighter or darker green or blue colour; head narrow, but apparently larger by reason of the very prominent eyes, vertex distinctly more narrow behind in the male than in the female, forehead narrow in front, moderately deeply impressed, the impression becoming wider behind, with fine divergent sulci, the space between smooth and shining, very finely strigose at base of eyes; antennæ very long and slender, more or less pitchy and flavescent (in some specimens darker, in others lighter), palpi flavescent; pronotum very long and slender, rather strongly constricted and impressed at the base, the basal angles being wider apart than the width of the broadest part, conical for two-thirds of its length, with the sides gently rounded, and then passing gradually into a slender pronotal collum, which is not strongly reflexed at the apex, upper surface finely strigose, or almost smooth, underside very finely punctured and pilose; elytra long, parallel-sided, with the shoulders bluntly marked, closely strongly and more or less evenly punctured throughout, somewhat rugosely so towards the suture for most of their length, the sculpture being almost as strong at the base as at middle, rather finer at the apex, especially in the female; there is a short luteous band in the centre and a reddish streak at the shoulders (both often more or less obsolete), and the extreme apical margin is whitish testaceous; metasternum very finely punctured, more or less pilose; legs red, with the tarsi and tibiæ more or less pitchy or brownish, the apical portion of the posterior tibiæ and the tarsi, except the apex, whitish testaceous.

Length 13 millim.

JAVA; SUMATRA.]

50. **Neocollyris ceylonica**, *Chaud.*

Collyris ceylonica, Chaudoir, Ann. Soc. Ent. France, 1864, p. 529; W. Horn, Spol. Zeyl. ii, 1904, p. 9.

Of a bright olivaceous green colour, with the palpi mostly pitchy; antennæ as in *N. arnoldi*; head narrower than in the latter species, with the sides behind the eyes a little rounder; pronotum of much the same shape, but less widened behind, and more obsoletely constricted at the base, upper surface obsoletely strigose transversely; elytra shorter, narrower, and more shining, with the shoulders less marked, more finely punctured, with the punctures towards the base and apex evidently finer and scarcer, the central part being rugose, and the apex being smooth; an abbreviated yellow central fascia and a red line behind the shoulders are present, and the apex is more broadly testaceous.

Length 12½ millim.

CEYLON.

51. **Neocollyris plicicollis**, *W. Horn.*

Neocollyris plicicollis, W. Horn, Deutsche Ent. Zeitschr. 1901, p. 63.

Allied to *N. arnoldi* and also to *N. variicornis* and *N. punctatella*; it differs from the first-named species in having the antennæ a little thickened externally (as in *N. subtilis*, Chaud., &c.), with the first five joints blue-black and the rest dark fuscous; not broader between the eyes, but with the frontal impression of about the same breadth between the parallel furrows, and only carinate at the extreme apex; the eyes are much less prominent and the vertex much less narrowed behind; the pronotum is a trifle less dilated towards the base, with the posterior portion a little less parallel-sided and slightly less narrowed anteriorly, the upper surface being somewhat more coarsely plicate, and rather thickly punctured (especially at the sides), under surface finely striate and distinctly punctured; metasternum practically impunctate; elytra with the shoulders less rectangular, somewhat dilated behind, much more finely punctured, with the punctures more widely distant on the anterior third, distinctly thicker behind the middle, and elongate and linear before the apex, the punctuation of the apex itself being rather close and fine, while the extreme margin is dark metallic and not testaceous as in the two preceding species: a short and broad reddish fascia at the centre and a thin rufescent line behind the shoulders are present; the palpi are blue-black, and the tibiæ and tarsi cyaneous; the head also is cyaneous, and the pronotum greenish cyaneous, the elytra being dull green and of a brighter olivaceous green towards base.

Length 14 millim. (13 mm. *sine labro*).

MADRAS: Nilgiri Hills.

The sculpture of the elytra is of the same character as in *N. variicornis*, except that the punctures are less close on the front half, and especially towards the base; behind the middle they are closer to one another.

Genus **TRICONDYLA**.

Tricondyla, Latreille, Latr. et Dej., Hist. Nat. Col. Eur. i, 1822, p. 65; Dejean, Spec. Col. i, 1825, p. 160: Lacordaire, Gen. Col. i. 1854, p. 28; Chaudoir, Bull. Soc. Moscou, 1860, p. 284.

Collyris, Fabricius (*ex parte*), Syst. El. i, 1801, p. 226.

Colliuris, Latreille (*ex parte*), Cuvier's Règne Animal, iii, 1817, p. 179.

Type, *Tricondyla aptera*, Oliv.

The genus *Tricondyla* is here regarded as separate from *Derocrania*; it appears to be entirely a matter of opinion whether they should be considered generically or subgenerically distinct. The characteristic large dark species of *Tricondyla* bear much the same relation to the delicate species of *Derocrania*, such as *D. nietneri*, Mots., and *D. agnes*, W. Horn, that the large species of the genus *Collyris* bear to the delicate species of *Neocollyris*, such as *N. linearis*, *N. subtilis*, &c. It is true that no intermediate species occur between *Collyris* and *Neocollyris*, whereas we do find intermediate forms between *Tricondyla* and *Derocrania*, but on the whole the analogy holds, and I have therefore separated them.

The chief characters of *Tricondyla* are as follows:—Head large, deeply excavate, with a distinct parallel-sided neck behind the eyes, not strangulate; eyes large and very prominent; antennæ long, filiform; labrum large, with six teeth, the central four being broad and blunt and the lateral ones sharper; maxillary palpi with the first joint slightly inflated, the second a little shorter than the first, and the third long, almost as long as the two others together; mentum very short at base, without, or with only a rudimentary, central tooth, side lobes much produced and developed, acute at apex; labial palpi strongly developed, the basal joint large and broad, the second longer and broader than the first at the base, subtriangular, gradually narrowed to apex, the third usually short; the characters, however, of the palpi appear to vary in different species; pronotum more or less parallel-sided, broad, constricted in front and behind, occasionally slightly convergent but without a collum in front; elytra narrowed in front, dilated and very convex behind; underside smooth and shining, mesosternum long, episterna of mesosternum very narrow and deeply sulcate; legs very long.

In both sexes the anterior, and in fact all the tarsi are more or less pubescent or rather spongy pilose beneath, but the anterior tarsi are more dilated in the male, and have the third joint very strongly dilated on its inner side. The armature of the upper margin of the last ventral segment is much the same as in *Collyris*, but the two central projections on the under margin, so characteristic of the latter genus, are wanting in *Tricondyla*, the centre of the margin being often more or less emarginate.

The species, as will be seen from the figures, much resemble large ants, but it appears to be open to doubt whether the resemblance is in any way significant, and not rather accidental: the likeness between *Tricondyla aptera*, Ol., and the large ant, *Camponotus gigas* (called by the natives *semut gajah* or "elephant ant"), which occur together in the Malay region, has been especially noticed by Mr. Ridley, and may be a case of true mimicry. This is noticed by Mr. Robinson in the 'Fasciculi Malayenses,' Zoology, pt. i. October 1903, p. 179, &c., from which we have already quoted an instance of mimicry bearing both on *Collyris* and *Tricondyla* (*supra*, p. 220); it may, however, be of interest to quote another instance from the same work bearing on *Tricondyla* alone. In speaking of *T. aptera* (*l. c.* p. 180) he says:—"I took two specimens of this species running about together on sand at the foot of a tall tree in open country. Their resemblance to a fossorial wasp (*Sphex lobatus*, F.), common in the same environment, was so marked that the Malays with me begged me not to touch them, remarking that wasps of that kind stung very badly. The wasp is seen frequently running about on sand, with its wings folded in such a way as to be very inconspicuous, but at the same time to somewhat veil the brilliant iridescent blue of the abdomen. It never runs straight for any distance, being probably employed in hunting other insects, perhaps 'ant-lions,' in the sand, but frequently stops for a moment and then resumes motion in another direction. The beetle had exactly the same gait and movements, and its resemblance to the wasp was due to this rather than to any very detailed similarity of form or colour, though in these respects, too, there is a general likeness even in the set specimens. In the present instance it would seem that the beetle mimicked the wasp, rather than the wasp the beetle, the wasp being by far the commoner of the two insects, and also the more noxious. The bearing of Mr. Ridley's observation (with regard to *T. aptera* and the ant *Camponotus gigas*) on this view is not clear, but in any case it is improbable that the resemblance between the Hymenopteron and the beetle was so close as in the instance observed by myself, for the movements of the ant referred to by Mr. Ridley bear a general likeness to those of the digging wasps, but are less rapid and abrupt, at any rate when the insects are undisturbed. The colour of the ant, moreover, is dark brown, instead of being metallic blue."

The whole question is very interesting, but our knowledge of these scarce genera is very limited at present. I cannot find that anything is known of the life-history of *Tricondyla* and *Derocrania*. The genus *Tricondyla* proper, as at present constituted, contains a dozen species, of which nine occur in the Indian region, three being confined to Ceylon. The range of the genus extends from the Philippine Islands to Hong Kong and New Guinea. The Indian species may be separated as follows:—

Key to the Species.

- I. Pronotum with the sides parallel as far as the apical constriction; upper surface never quite glabrous, and usually distinctly striolate transversely.
  - i. Sculpture not transverse, shagreened.
    - 1. Labrum and legs black .... *coriacea*, Chevr., p. 276.
    - 2. Labrum and legs in part red........ *nigripalpis*, W. Horn, [p. 276.
  - ii. Sculpture more or less distinctly transverse, rugose.
    - 1. Elytra longer and rather broader in the middle; sculpture more rugose, plain to apex .... *granulifera*, Mots., p. 277
    - 2. Elytra shorter and rather narrower in the middle; sculpture less rugose, much finer at apex .... *gounelli*, W. Horn, p. 278.
- II. Pronotum with the sides more or less widened and rounded, and more or less convergent before the apical constriction; upper surface glabrous (with at most extremely fine traces of striæ).
  - i. Sculpture of elytra shallower and less close, as a rule almost wanting on the posterior portion, which is more shining than the anterior .... *macrodera*, Chaud., p. 278.
  - ii. Sculpture of elytra deeper and closer, giving the upper surface a duller appearance.
    - 1. Sculpture of elytra distinctly finer behind.
      - A. Pronotum abruptly narrowed before the anterior constriction.... *cyanea*, Dej., var. *annuli-* [*cornis*, Schm.-Goeb., p. 279.
      - B. Pronotum gradually narrowed before the anterior constriction.... *tuberculata*, Chaud., [p. 280.

2. Sculpture of elytra not or scarcely finer behind.
   A. Size larger; sculpture of elytra less strong and less confluent in the middle .... *mellyi*, Chaud., p. 280.
   B. Size smaller; sculpture of elytra stronger and more confluent in the middle .... *gestroi*, Fleut., p. 281.

52. Tricondyla coriacea, *Chev.*

Tricondyla coriacea, Chevrolat, Rev. Zool. 1841, p. 221; W. Horn, Spol. Zeyl. ii, 1904, p. 39.

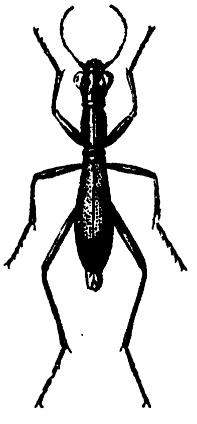

Fig. 121.—*Tricondyla coriacea* (nat. size).

Black, comparatively dull; labrum large, black, with the side teeth well marked; head rather shallowly excavate between the eyes, with the central portion rather convex, the striæ at the sides of the eyes not strongly marked, and with no distinct furrow at the base of the excavation, this being replaced by two shallow foveæ; pronotum long, parallel-sided, narrowed and strongly constricted at base and apex, with a central line and indistinct transverse striation; scutellum large, smooth; elytra narrowed towards base, widened behind, widest behind middle, and gradually narrowed to apex, closely evenly and strongly sculptured, but not rugose; the punctures are more or less triangular, and give the surface a scabrous or shagreened appearance; legs long, black; underside almost smooth; metasternum very finely sculptured.

There appears to be very little difference externally between the sexes; the single male I have seen is rather smaller, on an average, than the females, and has the elytra somewhat less narrowed at the apex.

Length 21–25 millim.

Ceylon: Kekirawa, Kanthalai, Palatupana, Trincomali (*Dr. W. Horn*, May), Chilaw, North-West Province (*E. E. Green*, Jan. 1910).

53. Tricondyla nigripalpis, *W. Horn.*

Tricondyla nigripalpis, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 224; id., Spol. Zeyl. 1904, ii, p. 39.

This species is intermediate between *T. coriacea* and *T. granulifera*, although much more closely allied to the former, which it resembles in general form and in the peculiar sculpture of the elytra; in the reddish colour of the margin of the labrum and part of the legs, and in the sculpture of the head and pronotum, as well as in its generally larger size it resembles *T. granulifera*; as in this species it has the suture of the elytra more or less marked by a smooth line; the punctures of the elytra are more or less confluent, whereas in *T. coriacea* they are separate, but this does not appear to be a very distinct character, and I am inclined to regard the insect as merely a variety of the last-named species.

Length 25 millim.

CENTRAL CEYLON.

54. **Tricondyla granulifera**, *Mots.*

Tricondyla granulifera, Motschulsky, Études Ent. 1857, p. 110, p. 3; W. Horn, Spol. Zeyl. ii, 1904, p. 38.
Tricondyla femorata, Walker, Ann. Nat. Hist. (3) ii, 1858, p. 202.
Var. *Tricondyla rugosa*, Chaud., Ann. Soc. Ent. France, 1863, p. 447.

Black, with a more or less distinct cyaneous, brassy or violaceous reflection, especially in front; underside sometimes brownish; elongate, narrower, more parallel-sided, and less dilated behind than in *T. coriacea*; labrum more or less red; head with the sulci and the striæ between the eyes strongly marked, and with a distinct furrow at the base of the excavation; pronotum with distinct transverse striation, more slender and elongate than in the preceding species; elytra with strong, horizontal, confluent rugose sculpture, the interstices in the middle forming more or less parallel ridges in some specimens, but variable, suture marked by a smooth line; legs long, more or less red or pitchy red; underside almost smooth, but sometimes with distinct traces of striæ on the prosternum.

Length 24–27 millim.

CEYLON: Haragaru, Nalanda (*Horn*, April).

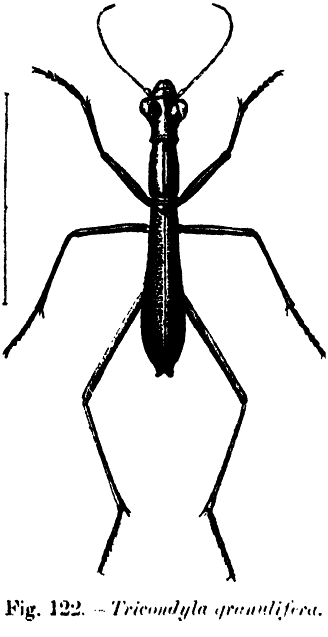

Fig. 122.—*Tricondyla granulifera.*

Var. rugosa, *Chaud.*

This variety is distinguished by its more robust form, which is more widened behind, and coarser sculpture. Dr. Horn is quite right (Deutsche Ent. Zeitschr. 1892, p. 209) in regarding it as merely a variety. There is considerable variation in the ordinary specimens of *T. granulifera*.

Length 24 millim.

CEYLON.

55. Tricondyla gounelli, *W. Horn.*

Tricondyla gounelli, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 361.
Var. *Tricondyla horni*, Maindron, Bull. Soc. Ent. France, 1904, p. 263.

Allied to *T. granulifera*, which it resembles in having the pronotum elongate and parallel-sided, but it differs chiefly in the sculpture of the elytra, which are also a little shorter and less narrow in the middle; the whole surface is covered with fine and more or less transverse punctiform impressions; two or three of these are often confluent transversely and so form irregular wavy lines; in the middle they are more separate, and at the apex are very fine and scanty, and almost disappear; the palpi are black, and the labrum and first four joints of the antennæ are metallic black, the 3rd and 4th joints being variably ringed with red; the sculpture of the thorax is very fine.

Length 23 millim. (21½ *sine labro*).

MADRAS: Ramnad (*Favre*), Anaimalai Hills (*H. L. Andrewes*). Concerning this species Mr. Andrewes makes the following note:—"May, 3500–4000 ft. On two occasions on the same tree, running round the bole."

Var. **horni**, *Mndr.*

Larger and more robust than the type, with the first and second joints of the antennæ, at least in part, red; the longitudinal orbital striæ and the transverse striation of the pronotum finer, and the elytra more strongly sculptured and rugose to the apex, which is a little more gibbose; the general colour is a uniform and more or less bright bronze-green; the femora are for the most part red, but more or less blue on their upper surface.

Length 20–25 millim.

MADRAS: Mountains of Travancore (*Favre*).

56. Tricondyla macrodera, *Chaud.*

Tricondyla macrodera, Chaudoir, Bull. Soc. Moscou, 1860, p. 300.

Deep black, rather shining; head large, with the eyes very prominent, orbital striæ as a rule not marked, but variable, excavation between the eyes deep and narrow, with strong sulci, and without impression at base; antennæ black, basal joints more or less ringed with red; pronotum with the sides distinctly contracted before the anterior constriction, upper surface almost smooth or with very fine transverse striation; elytra constricted towards base, widened and gibbose behind, basal portion strongly rugose transversely, central part diffusely and roughly punctured, apical third almost smooth; femora, except apex, red, tibiæ and tarsi pitchy black; underside smooth or almost smooth.

Length 19–22 millim.

SIKKIM: Darjiling, Mungphu; BHUTAN; ASSAM: Sibsagar, Cachar; TONKIN.

This species varies a good deal in the excavation and striation of the head, the length of the narrowed part of the pronotum, and the length, gibbosity, and sculpture of the elytra; the apical portion of the latter is usually almost smooth and impunctate, but in the specimens before me from North Cachar it is plainly sculptured to the apex.

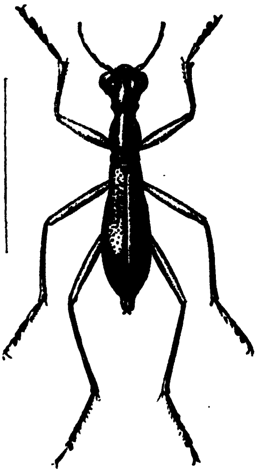

Fig. 123.—*Tricondyla macrodera.*

57. **Tricondyla cyanea**, *Dej.*, var. **annulicornis**, *Schm.-Goeb.*

Tricondyla cyanea, Dejean, Spec. Col. i, 1825, p. 161.
Tricondyla annulicornis, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 10.
Tricondyla gibba, Chaudoir, Bull. Soc. Moscou, 1861, p. 358.

Black or bluish, with the femora, except apex, red and the tibiæ and tarsi black with a blue reflection; head strongly excavate, with the orbital striæ well marked; antennæ with the 3rd and 4th joints ringed with red, palpi nigro-cyaneous; pronotum convex, rather abruptly narrowed before the anterior constriction, not widened in the middle and almost cylindrical, smooth and glabrous, with a fine central line; elytra widened and strongly gibbose behind, more or less distinctly plicate transversely before the middle, rather strongly punctured in the middle, and much more finely and sparingly behind.

Length 19 millim.

BURMA; TENASSERIM; SIAM; CAMBODIA.

There are several races of this species, which appears to be very variable; the one above described, which is the only one found within our limits, is longer in form than the rest, and differs also in the more gibbose hind portion of the elytra, the longer and narrower pronotum, and the somewhat smaller head and flatter eyes.

From *T. mellyi* and *T. gestroi* this species may easily be known by the sculpture of the elytra, and from *T. tuberculata* also by the broader pronotum and more gibbose elytra.

58. **Tricondyla tuberculata**, *Chaud.*

Tricondyla tuberculata, Chaudoir, Bull. Soc. Moscou, 1860, p. 310; Fleutiaux, Ann. Soc, Ent. France, 1893, p. 500.

Elongate, parallel-sided, gradually but not strongly widened, and not strongly gibbose behind; in general form much resembling *T. granulifera*, var. *rugosa*, Chaud.; colour black: antennæ with the 3rd and 4th joints more or less ringed with red; femora red, except at apex, tibiæ and tarsi pitchy black or brown; frontal sulci very deep, with the space between smooth and slightly raised, orbital striæ well marked; pronotum glabrous or almost glabrous, parallel-sided to about middle and from thence very gradually contracted to the apical constriction; elytra strongly, evenly and rugosely shagreened (much more coarsely than in *T. coriacea*), the rugosity being more evident at base, and the sculpture being less pronounced before apex, and very much less marked at the extreme apex; underside smooth.

Length 18–20 millim.

Assam: Sylhet, Silcuri, Cachar.

59. **Tricondyla mellyi**, *Chaud.*

Tricondyla mellyi, Chaudoir, Bull. Soc. Moscou, 1850, p. 17; Fleutiaux, Ann. Soc. Ent. France, 1893, p. 500.

Tricondyla tumidula, Walker, Ann. Mag. Nat. Hist. (3) iii. 1859, p. 50.

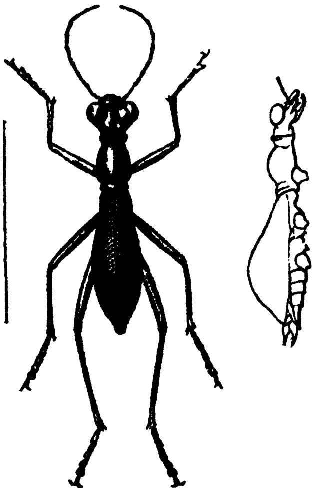

Fig. 124.—*Tricondyla mellyi.*

Larger than the preceding species which it much resembles in other respects; head with the sulci between the eyes very strongly marked, and the orbital striæ variable but usually distinct; pronotum broader and more ample, with the contraction before the apical constriction rather more marked: elytra less abruptly narrowed behind and not so strongly or rugosely sculptured; legs pitchy red, with the tibiæ and tarsi darker.

Length 22–24 millim.

Bengal; Assam: Silcuri, Cachar; Tonkin.

Chaudoir, in his original description, compares this species in detail with *T. aptera*, from which it is abundantly distinct. Fleutiaux (*l. c.*) says that it may easily be distinguished by the coarse and thick sculpture of the posterior portion of the elytra. Its nearest allies are *T. tuberculata* and *T. gestroi*; from the former of these the last mentioned character will certainly distinguish it, but in the only specimen of *T. gestroi* which I have seen, and which was determined by Gestro himself, the punctuation is quite as strong at the apex as in *T. mellyi*, and apart from its smaller size and the stronger sculpture of the elytra, which is more confluent near the suture in and about the middle, it would be hard to separate it from the last-named species.

60. Tricondyla gestroi, *Fleut.*

Tricondyla gestroi, Fleutiaux, Ann. Soc. Ent. France, 1893, p. 500.
Tricondyla mellyi, Gestro (*nec* Chaud.), Ann. Mus. Genova. 1893, p. 370.

Nigro-violaceous, black or cyaneous black; closely allied to *T. tuberculata*, but a little more shining, with the orbital striæ scarcely marked, and the pronotum more gibbous and less gradually contracted in front; the elytra are more abruptly and less gradually narrowed in front, and the widened and convex part behind is therefore more distinct; the sculpture of the middle part is deeper and stronger, but the difference is not very apparent: femora red, tibiæ and tarsi dark brown.

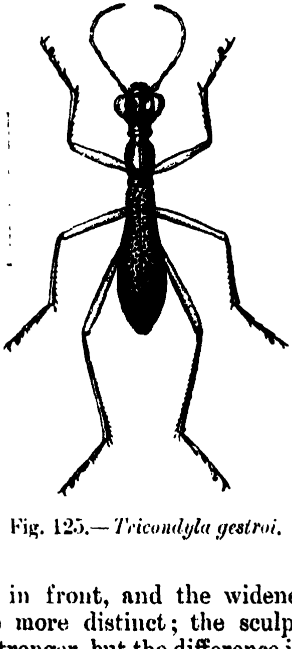

Fig. 125.—*Tricondyla gestroi.*

Length 18–19 millim.

Assam: Sylhet; Burma: Karen-ni; Cochin China.

Genus DEROCRANIA.

Derocrania, Chaudoir, Bull. Soc. Moscou, 1860, pp. 284 & 297
W. Horn, Spol. Zeyl. 1904, p. 39.

Type, *Derocrania dohrni*, Chaud. (=*scitiscabra*, Walk.).

The insects belonging to this genus are smaller and more slender than those belonging to the genus *Tricondyla*, some of them being very delicate. The resemblance to ants of various species is very striking; in many characters they closely resemble *Tricondyla*, but may be known by having the head between the eyes less excavate, and in several cases level, smooth, and even slightly convex, and the vertex more or less strongly strangulate behind, without the parallel neck which is characteristic of *Tricondyla*. The pronotum is much more slender and elongate, and often, but not always, produced into a distinct and more or less elongate collum in front, as in *Neocollyris*; the sculpture of the pronotum is in some cases distinctly rugose transversely; elytra elongate, more or less distinctly widened behind, sometimes very strongly raised behind, sometimes almost flat, with very variable sculpture; antennæ and legs very long and slender; apex of the last abdominal sternite pointed in the female; the apophysis or armature of the posterior margin of the last tergite appears to be variable and much more marked in some species than in others.

The whole of the species which have been hitherto described are confined to the Indian region, and ten of them have occurred only in Ceylon; they may be separated as follows:—

I. Elytra with strong longitudinal sulci, very gibbose; pronotum with a distinct collum.
  i. Pronotum shorter and broader; sulci and elytra shallower and less regular .... *honorei*, Fleut., p. 283.
  ii. Pronotum longer and narrower: sulci of elytra deeper and more regular .... *longesulcata*, W. Horn, [p. 284.
II. Elytra with longitudinal sculpture, but with the impressions separate, and more or less irregularly confluent in parts, cateniform: pronotum conical, without distinct collum ...... *brevicollis*, W. Horn, p. 285.
III. Elytra punctured or transversely rugose.
  i. Forehead not excavate; pronotum with a distinct collum.
    1. Punctuation of elytra very fine and evanescent behind; slender and very delicate species ......
      A. Collum of the pronotum shorter: elytra smooth from just behind middle .... *nietneri*, Mots., p. 285.

B. Collum of the pronotum longer: elytra very finely punctured behind; the most elongate and graceful species of the genus .. *agnes*, W. Horn, p. 286.

2. Punctuation of the elytra deep and dense behind.

A. The two longitudinal frontal sulci (or plicæ) not reaching the level of the punctiform impression near the border of each orbit .... *fusiformis*, W. Horn, p. 286.

B. The two longitudinal frontal sulci (or plicæ) continued beyond the lateral impressions.

a. Pronotal collum long and thin; tibiæ, antennæ, and palpi black .... *gibbiceps*, Chaud., p. 287.

b. Pronotal collum short and stout; tibiæ, joints 3-6 of antennæ, and the last two joints of the palpi testaceous. *flavicornis*, W. Horn, p. 287.

ii. Forehead shallowly and widely excavate; pronotum without a distinct collum: elytra strongly punctured.

A. Punctuation very coarse and not so close; elytra more parallel and less gibbose behind ...... *concinna*, Chaud., p. 287.

B. Punctuation strong and close, but less coarse; elytra more widened and more gibbose behind ...... *schaumi*, W. Horn, p. 289.

iii. Forehead evidently excavate, but without transverse impression behind; pronotum without a distinct collum; elytra with transversely rugose sculpture .... *nematodes*, Schaum, p. 289.

iv. Forehead deeply excavate, with a more or less arcuate impression behind the frontal sulci; pronotum with a distinct collum.

A. Middle of the elytra strongly and separately punctured; size smaller .... *scitiscabra*, Walk., p. 291.

B. Middle of the elytra coarsely and transversely, confluently and rugosely sculptured; size larger .. *halyi*, W. Horn, p. 292.

61. Derocrania honorei, *Fleut.*

Derocrania honorei, Fleutiaux, Ann. Soc. Ent. France, 1893, p. 502.

Black or æneous black, rather shining; head large, slightly excavate, with a longitudinal furrow on each side between the eyes; pronotum lagenoid, broader and gibbose behind, and with a distinct narrow collum in front (in the female the pronotum is considerably shorter and more ample than in the male); collum slightly rugose, hinder part smooth with a very fine central line; elytra much narrowed in front, strongly gibbose behind, rugose toward apex, and with the sculpture behind forming more or less long and regular furrows which become very irregular at the sides and obsolete at the apex: legs red, apical portion of tibiæ and the tarsi black.

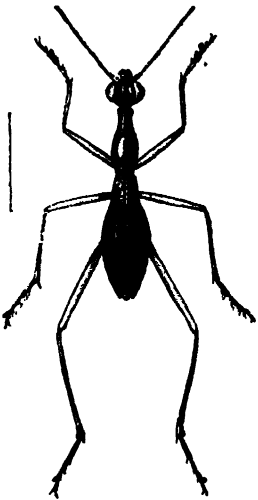
Fig. 126.
Derocrania honorei.

Length 11–12 millim.

Bombay; Madras: Palni Hills, Kodaikanal, Trichinopoli, Ramnad.

In the male the head is slightly more excavate between the eyes, the dilated portion of the pronotum is narrower, and the longitudinal sulci of the elytra are more regular; the pronotal collum is very distinct in both sexes. It is possible that in a long series these differences may be found not to be sexual.

62. **Derocrania longesulcata**, *W. Horn.*

Derocrania longesulcata, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 194; Maindron & Fleut., Ann. Soc. Ent. France, 1905, p. 8, pl. i, fig. 1.

Closely allied to *D. honorei*, and especially resembling the male of that species, from which it differs in having the head smaller and the forehead flatter between the eyes, and both the collum and the posterior part of the pronotum longer and narrower: the collum is strongly constricted and cylindrical and more evidently plicate transversely, and the hinder part is more parallel and gibbose; the basal portion of the elytra is narrower and more deeply and granulately punctured, and the inflated part behind is much more deeply and regularly sulcate longitudinally, the sulci beginning nearer the base, and being continued nearly to the apex; the six or seven median sulci are quite regular and parallel, and the lateral ones are about the same as the discoidal ones in *D. honorei*; the general colour of the insect is blacker than in the last-named species.

Length 11 millim.

Madras: Nilgiri Hills, Anaimalai Hills, Travancore.

Mr. H. L. Andrewes has taken this species in the Nilgiris (4500–6000 ft.) in April, May and June, by beating. He states that it closely resembles an ant, runs very rapidly, and has an offensive odour.

63. Derocrania brevicollis, *W. Horn.*

Derocrania brevicollis, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 152; id., Gen. Insect. Cicind. pl. 8, fig. 3.

This species differs from both the male and female of *D. honorei* to which it is allied, by having no distinct pronotal collum, the pronotum being much shorter, simply conical and not lagenoid; the gibbose portion of the elytra begins nearer the base and the broadest part is in the middle; the basal portion is more closely and thickly sculptured than in *D. honorei*, and the rest of the upper surface is about as coarsely sculptured as the basal part; the punctures towards the lateral margins and the apex are a very little smaller, and are not or scarcely joined longitudinally in irregular fashion; the punctures on the disc and near the suture are somewhat oblong and very slightly confluent longitudinally, but do not form more or less long sulci as in the last-named species; the chief part of the tibiæ is reddish.

The elytra, according to Dr. Horn, appear to be more or less uniformly, though irregularly, thickly and closely punctured; on the top of the convex portion the individual elongate impressions unite in the form of a chain, but do not form actual elongate sulci, the individual impressions being very marked.

Length 10½ millim.

MADRAS: Trichinopoli.

64. Derocrania nietneri, *Mots.*

Derocrania nietneri, Motschulsky, Études Ent. viii, 1859, p. 25; id., op. cit. xi. 1862, p. 23.
Derocrania lævigata, Chaudoir, Bull. Soc. Moscou, 1860, p. 299.
Derocrania raphidioides, Schaum, Berlin Ent. Zeitschr. 1861, p. 75.
Var. *Derocrania obscuripes*, Bates, Ann. Mag. Nat. Hist. (5) xvii, 1886, p. 70.

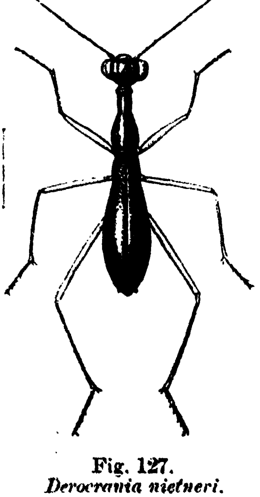

Fig. 127.
Derocrania nietneri.

An elongate and delicate species; shining black with a more or less distinct æneous or greenish æneous reflection; head large and very broad in proportion to the collum of pronotum, smooth, shiny, and convex between the eyes, occasionally slightly depressed; pronotum lagenoid or flask-shaped, with a long and very narrow collum, which is slightly rugose on its upper surface, dilated part broadest behind middle, smooth, with a very fine central line; elytra gradually and not abruptly narrowed to base, considerably but gradually dilated behind, not gibbose; upper surface rather strongly, but not very closely, punctured in front, very finely and diffusely in the centre, and smooth and glabrous towards apex; the sculpture is, however, a little variable:

antennæ very long, filiform, pitchy; legs red or testaceous, apex of tibiæ and the tarsi pitchy; apex of elytra produced into a point which is more evident in the female than in the male.

Length 10–12 millim.

CENTRAL CEYLON: Balangoda Ridge, Kandy, July (*E. E. Green*).

The var. *obscuripes*, Bates, has the legs of a rather dark testaceous red colour and the apices of the tibiæ and tarsi darker piceous.

65. Derocrania agnes, *W. Horn.*

Derocrania agnes, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 64; id., Gen. Insect. Cicind. pl. 8, fig. 4.

Closely allied to *D. nietneri*, but much more slender, with the head very slightly smaller and the collum of the pronotum evidently longer: the elytra are somewhat more elongate, with the sculpture more evident, slightly coarser in front, less evanescent in the middle, and about as distinct behind as it is on the central portion in *D. nietneri*; the legs are much longer than in the last-named species, and the lateral portions of the mentum, which in that species are spinose and strongly deflexed, are much shorter, less blunt and straighter; the trochanters are pitchy brown, and the femora and tibiæ reddish brown, the latter being more or less black; the tarsi and antennæ are black or partly metallic.

Length 13½ millim.

CEYLON.

66. Derocrania fusiformis, *W. Horn.*

Derocrania fusiformis, W. Horn, Spol. Zeyl. 1904, p. 35, pl. 7, fig. 1.

Very closely allied to *D. gibbiceps*, but narrower, with the forehead between the eyes even less excavate, and the two longitudinal sulci less distinct and shorter, not reaching beyond the juxta-orbital impressions; the dilated portion of the pronotum is less cylindrical and more narrowed in front, and the free anterior margin is less deeply emarginate; the elytra are narrower and more parallel-sided, much less dilated in the middle and behind, and more finely and a little more thickly punctured; the tibiæ and tarsi are brownish and not cyaneous, and the pronotum and elytra have no metallic tinge.

Length 13–13½ millim. (*sine labro*).

CEYLON.

Dr. Horn compares this species with *D. nietneri* as well as with *D. gibbiceps*; it is, however, apparently much more closely allied to the latter species. The lighter legs, metallescent colour, and, above all, the sculpture of the elytra, will at once separate it from *D. nietneri*; the colour, however, can hardly be depended upon as a character in the case of a unique specimen.

67. **Derocrania gibbiceps**, *Chaud.*

Derocrania gibbiceps, Chaudoir, Bull. Soc. Moscou, 1860, p. 298.

Black, with slight metallic reflection, pronotum in front, or altogether, rufescent; head slightly excavate, smooth, with the frontal sulci raised and prolonged beyond the small punctiform impression near the anterior portion of the eyes, sometimes with two impressions between their bases; pronotum lagenoid, shaped much as in *D. nietneri*, but with the widened part more parallel-sided and cylindrical, and the collum slightly wider, the upper surface almost smooth; elytra strongly narrowed in front and much widened and slightly gibbose behind, strongly and deeply punctured throughout except at the extreme apex, the punctures being very close together, but not or scarcely confluent, and being smaller and more crowded at the base; femora, except apex, red; tarsi, tibiæ, and apex of femora cyaneous.

Length 12–13 millim.

CENTRAL CEYLON.

In general shape this species resembles *D. nietneri*, but it is larger and more widened behind, and may at once be known by the sculpture of the elytra; from *D. concinna* it may be easily distinguished by the shape of the head and pronotum.

68. **Derocrania flavicornis**, *W. Horn.*

Derocrania flavicornis, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 92; id., Spol. Zeyl. 1904, p. 35, pl. 7, fig. 1.

According to Dr. Horn this species is intermediate between *D. gibbiceps* and *D. nematodes*; the head and pronotum are as in the former, but the collum of the pronotum is considerably shorter and stouter, the forehead is more excavate, and the longitudinal sulci or plicæ are more sharply marked and raised; in general shape the elytra resemble those of *D. nematodes*, but they are narrower and more fusiform, and the transverse rugosities are not so distinctly impressed; the antennæ have the first two joints cyaneous, and the rest, or at least joints 3–6, red or testaceous; the femora and the tibiæ, except the extreme apex, are reddish yellow, the apex and the tarsi being more or less metallic; elytra terminating externally in two blunt points.

Length 14–15 millim.

CEYLON.

One example of this species exists in Dr. Horn's collection, and one in the Vienna Museum.

69. **Derocrania concinna**, *Chaud.*

Derocrania concinna, Chaudoir, Bull. Soc. Moscou, 1860, p. 298.

This species resembles *D. nematodes* in general appearance, but is rather smaller on the average, and may easily be distinguished by the shape of the head, which is smooth and flat between the eyes, and by the less confluent sculpture of the elytra; the colour is dark with an æneous or greenish æneous reflection; head broad, smooth, with the space between the eyes very slightly excavate and with the orbital striæ wanting or very slightly marked; frontal sulci near eyes strong and deep and divergent at base; between the base of the eyes there are two distinct impressions, which are sometimes confluent; pronotum often more or less rufescent, subcylindrical, subparallel-sided, very gradually and not strongly narrowed to apex, without a distinct collum, basal constriction very feeble, upper surface more or less distinctly striolate transversely; elytra very gradually narrowed towards base, slightly widened behind and not gibbose in the male, more strongly widened and slightly gibbose in the female, with strong and rugose sculpture, which, however, is much less confluent than in the preceding species, and does not form wavy lines; the punctures are more diffuse at the sides and apex, but are strong throughout; antennæ very long and slender, pitchy; legs dark, metallic; femora, except apex, red.

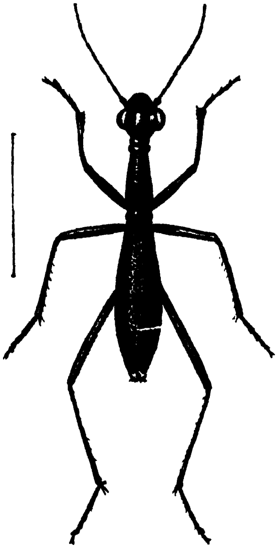

Fig. 128.—*Derocrania concinna.*

Length 15–17 millim.

CEYLON: Kandy.

70. Derocrania schaumi, *W. Horn.*

Derocrania schaumi, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 67.

Very like *D. scitiscabra*, Walk. (= *S. dohrni*, Chaud.), which it closely resembles in colour and sculpture; but it may at once be known by the formation of the head, which is smooth, with no deep arcuate excavation behind the frontal sulci; the pronotum has a much shorter and more indistinct collum, the dilated part passing into it quite gradually, and the elytra are more distinctly foveolate, and are (in the only specimen I have seen) at their widest further behind the middle; the base, however, is less rugosely sculptured.

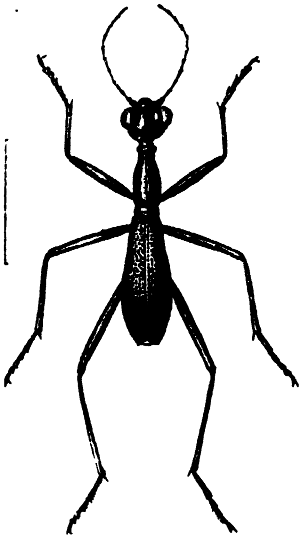

Fig. 129.—*Derocrania schaumi.*

Length 16 millim.

CEYLON.

71. Derocrania nematodes, *Schaum.*

Derocrania nematodes, Schaum, Journ. Ent. 1863, p. 61, pl. 4, fig. 1.

Elongate, metallic, æneous or greenish æneous, or with a steely-blue reflection; head large, distinctly excavate, with the space between the eyes smooth and slightly convex; the frontal sulci proper are strong and curved, and the supra-orbital striæ are more or less strongly marked; the space behind the eyes is rather long and rounded and not abruptly strangulate; pronotum gradually and not strongly narrowed from the basal to the apical constriction, with strong transverse striation; elytra very gradually and not strongly narrowed to apex, widened, but not gibbose,

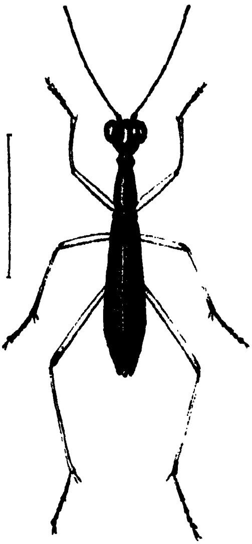

Fig. 130.—*Derocrania nematodes.*

behind; upper surface rather strongly and rugosely sculptured throughout, the sculpture being scarcely less coarse at the apex and being more or less confluent in wavy lines; apex produced into two variable points or processes, which are stronger in the female than in the male; antennæ long, filiform, red, or more or less pitchy; legs red or testaceous, with the tibiæ in part, and the tarsi, and occasionally the apex of the femora, darker; metasternum striate at the sides.

Length 16–18 millim.

CENTRAL CEYLON.

This insect is somewhat variable in one or two respects; the pronotum is occasionally somewhat abruptly contracted in front and there is a rather distinct short collum, and the striation, which is, as a rule, very strong, is sometimes very little marked: this applies also to the striation of the head and of the metasternum; occasionally there is a slight transverse furrow at the base of the eyes.

72. Derocrania scitiscabra, *Walk.*

Derocrania scitiscabra, Walker, Ann. Nat. Hist. (3) iii, 1859, p. 51.
Derocrania dohrni, Chaudoir, Bull. Soc. Moscou, 1860, p. 297.

Black, or black with a very obscure æneous reflection, much widened behind, of a dark and scabrous appearance; head strongly excavate, with the central portion flat and smooth and the sulci very strongly marked, divergent at base, with a large arcuate posterior excavation just behind them; orbital striæ faint, sometimes almost wanting; pronotum long, with a long and distinct, but not very abrupt, collum, hinder part moderately widened, upper surface more or less distinctly striolate, basal constriction not strong; elytra strongly and closely sculptured throughout except at the extreme tip, somewhat rugose at the base, apical portion more or less coarsely punctured; they are strongly widened behind, more so in the female than in the male, but are not very markedly gibbose; in both sexes the apices of the elytra terminate externally in a short point; antennæ and legs black or pitchy; underside rather shiny, glabrous, or with indistinct traces of striæ on the pro- and meso-sternum.

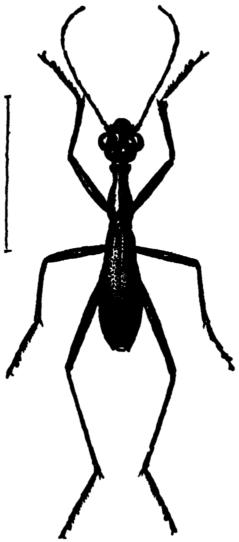

Fig. 131.—*Derocrania scitiscabra.*

Length 17–19 millim.

CEYLON: Kandy.

This species lives in the forest, running moderately fast on tree-trunks, seldom on the ground (*Horn*).

73. Derocrania halyi, *W. Horn.*

Derocrania halyi, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 193; id., Spol. Zeyl. 1904, p. 39, pl. 7, fig. 3.

The largest species of the group; colour metallic, bronze or purplish red; head large, strongly excavate, with the striæ behind eyes very distinct, and with strong longitudinal sulci, at the base of which there is a large arcuate excavation, as in *D. scitiscabra*; pronotum elongate, with a distinct collum, thickly and rather strongly transverse-striate; elytra long, subparallel-sided, not much narrowed in front or widened behind, and not gibbose, in form and sculpture resembling *Tricondyla granulifera*, Mots., the sculpture, especially in the middle, being very strong, transversely confluent, and rugose, the interstices being raised in irregular transverse ridges; antennæ dark, with the first and second joints and the apex of the third and fourth more or less distinctly reddish; femora red or reddish, tibiæ and tarsi dark, more or less metallic; elytra terminating externally in two sharp points.

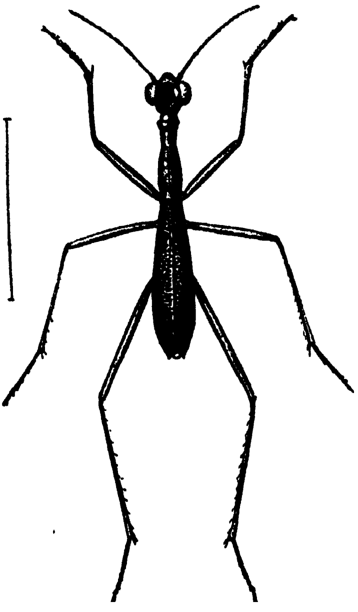

Fig. 132.—*Derocrania halyi.*

Length 20–21 millim.

CEYLON.

There is an old male specimen of a *Derocrania*, which has been for many years in the Oxford Museum, and which must evidently be referred to this species; apart from the sculpture, etc., it is chiefly remarkable for its very long legs, a point which Horn does not notice in his description. His figure (*l. c.*) represents a more robust insect, which is probably the female; the legs are not figured.

Division *PLATYSTERNALIÆ.*

Platysternaliæ, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 10.

This division contains all the CICINDELIDÆ except the CTENOSTOMINÆ and COLLYRINÆ, from which they are distinguished, as before stated, by the broad, flat and smooth episterna of the metasternum. Two subfamilies are represented in the Indian fauna, the THERATINÆ and CICINDELINÆ, which may be separated as follows:—

I.	Outer lobe of the maxillary palpi obsolete and represented by a seta-like process	**Theratinæ**, p. 293.
II.	Outer lobe of the maxillary palpi normal ..	**Cicindelinæ**, p. 300.

Subfamily THERATINÆ.

The single genus comprised in this subfamily may easily be known by having the outer lobe of the maxillary palpi obsolete and represented by a minute seta-like process. By some authors it is included under the COLLYRINÆ, to which it is in certain points related, as, for instance, in the formation of the apex of the seventh ventral segment of the abdomen in the female, which much resembles that of *Collyris*, its posterior margin being furnished in the centre with two short processes similar to those which are so characteristic of the last-named genus; in some cases, however, these appear to be much reduced. In general appearance the species resemble the CICINDELINÆ much more than the COLLYRINÆ; from the former family, however, they are distinguished (apart from the structure of the outer lobe of the maxillary palpi) by the absence of a tooth in the centre of the emargination of the mentum, and by having the tarsi almost alike in both sexes, the first two joints being elongate and subcylindrical, the third much shorter and slightly emarginate at apex, and the fourth very short and heart-shaped; the labrum is very large and long, and practically covers the mandibles, the tips only being visible when at rest; the

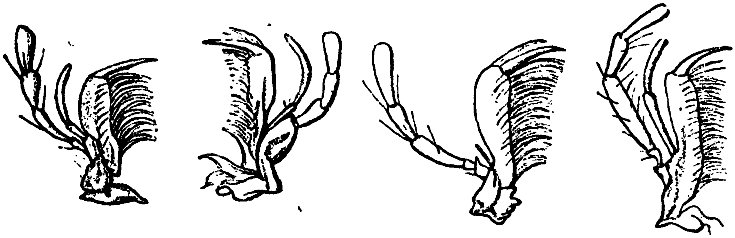

Fig. 133.—Maxilla (left to right) of *Collyris*, *Tricondyla*, *Therates*, *Cicindela*.

head is large and excavate between the eyes, which are very large and prominent, and the vertex is long behind the eyes, gradually contracted, and somewhat strangulate at the base; the pronotum is convex and smooth, globular or transversely globular, and the elytra are parallel-sided, with the shoulders well marked and more or less strongly raised on each side of the suture; the legs are very long and slender.

Genus THERATES.

Therates, Latreille, Règn. Anim. (ed. 1) iii, 1817, p. 179; Lacordaire, Gen. Col. i, 1854, p. 28.

Type, *Cicindela labiata*, Fabr.

Thirty-four species are contained in this genus, which range from the Philippine Islands to New Guinea, and occur chiefly in the islands of the Malay Archipelago, while three or four have been described from Tonkin. The genus was not known to occur in the Indian region until comparatively recently; two species only are recorded by Fleutiaux in his 'Catalogue of the CICINDELIDÆ,' published in 1892, but several species have since been found by Doherty and others in Assam and Burma, and one is recorded from Darjiling.

Key to the Species.

I. Size larger; length 12–13 mm.
  i. Pronotum broader in the middle and more strongly rounded at the sides; form larger and more robust .... *dormeri*, W. Horn, p. 295.
  ii. Pronotum narrower in the middle and less strongly rounded at the sides; form smaller and less robust .... *hennigi*, W. Horn, p. 296.
II. Size smaller; length 6–9 mm.
  i. Pronotum not or scarcely transverse; head not or very feebly impressed behind eyes .... *dohertyi*, W. Horn, p. 296.
  ii. Pronotum more or less distinctly transverse.
    1. Elytra with a straight yellow band on each behind the middle, not quite reaching the suture, more or less merging into the testaceous colour of the front part, but well defined behind .... *chenelli*, Bates, p. 297.
    2. Elytra with the light patch behind the middle oblique, sometimes more or less obscure.
      A. Interocular space not quite smooth; head with a deep transverse impression at base of frontal sulci .... *obliquus*, Fleut., p. 208.

B. Interocular space smooth.
  a. Size larger; longitudinal furrows near orbits of eyes less produced and shallower; front with three short longitudinal wrinkles behind these furrows. *gestroi*, v. *annandalei*, [W. Horn, p. 298.
  b. Size smaller; longitudinal furrows near orbits of eyes deeper and produced further behind; front with two punctiform impressions behind these furrows. *waagenorum*, W. Horn, [p. 299.

74. Therates dormeri, *W. Horn.*

Therates dormeri, W. Horn, Deutsche Ent. Zeitschr. 1898, p. 197.

Considerably larger than any of the other Indian species except *T. hennigi*, from which it differs in being a little larger and stouter, and in having the pronotum wider in the middle; labrum reddish testaceous; head large, vertex broad, frontal sulci deep, slightly convergent towards base and terminating in a distinct transverse impression, so that the portion between the sulci appears raised and subquadrangular, orbital striæ rather distinct; pronotum broad, very short and transverse, the central portion being about twice as broad as long, very strongly rounded at the sides, strongly constricted in front and behind; elytra dark, with the basal portion irregularly testaceous, the raised callosities being in part dark, and with a regular transverse yellow band on each just behind the middle, not quite touching the suture; the apex is whitish testaceous; punctuation rather strong towards base, and irregular in size (the callosities being marked with several very large punctures), feeble in middle, obsolete towards apex; legs testaceous, more or less marked with fuscous, posterior tibiæ and half the tarsi whitish except the claws; underside pitchy, almost smooth.

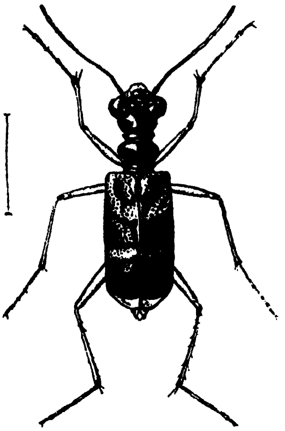
Fig. 134.—*Therates dormeri.*

Length 13 millim.

ASSAM: Patkai Hills (*Doherty*).

The species was originally described by Dr. W. Horn on a single specimen from Borneo.

75. Therates hennigi, *W. Horn.*

Therates hennigi, W. Horn, Ent. Nachtr. xxiv, 1898, p. 178.

Allied to *T. dormeri*, which it resembles in size, but differs from it in being a little smaller and less robust, and in having the pronotum narrower. Also allied to *T. chenelli*, but differs in its much larger size, and in having the forehead between the eyes broader and flatter and more abrupt and deflexed in front; the pronotum is very slightly shorter and broader; the elytra are much more coarsely sculptured behind, but a little more finely and much more diffusely than at the base, and are entirely flavo-testaceous, with the exception of two purplish æneous spots on each, which touch the margin and almost reach the suture, the one a little constricted in the middle and situated a little before the centre, the other larger and irregular and almost round, situated between this and the apex; the antennæ have the last four joints strongly dilated, compressed and dark, the preceding one being brownish testaceous; the front parts are cyaneous, and the abdomen black with a narrow yellow margin; the legs are flavo-testaceous, with the tarsi mostly pitchy and with other dark markings.

Length 12 millim. (11 mm. *sine labro*).

ASSAM: Khasi Hills.

76. Therates dohertyi, *W. Horn.*

Therates dohertyi, W. Horn, Stettin. Ent. Zeit. 1905, p. 277.

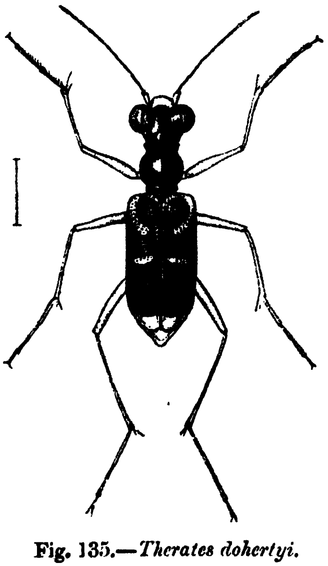

Fig. 135.—*Therates dohertyi.*

One of the smallest species of the genus; labrum reddish testaceous; head and pronotum metallic blue or æneous; head with two strong frontal sulci which terminate behind in more or less distinct impressions, sometimes obsolete; antennæ pitchy red, with the basal joints darker; palpi testaceous; pronotum less transverse and more globular than in *T. chenelli*; elytra dark, with an elongate testaceous spot at each shoulder, sometimes encircling the raised basal callosities, which are marked with testaceous at the base; there is also on each just behind middle a rather narrow straight or lunate spot, and the apex is testaceous; the sculpture is distinct, but more or less diffuse towards base, and almost obsolete on the posterior third; legs testaceous but somewhat darker at the apex of the femora, and variable; underside pitchy or pitchy red.

Length 7½–8 millim.

Assam: Patkai Hills; Burma: Pegu; Tenasserim.

There is a small series in very bad condition, unnamed, in the Indian Museum, in which the colour of the elytra is very variable, the testaceous tint prevailing.

77. Therates chenelli, *Bates.*

Therates chenelli, Bates, Cist. Ent. ii, 1878, p. 335.
Therates concinnus, Gestro, Ann. Mus. Genova, 1888, p. 105.

A small species, with the elytra very variable in colour, except that the light yellow fascia just behind the middle seems to be more or less distinct, though often ill-defined in front and merging into the testaceous colour of the front part; labrum testaceous or reddish testaceous, occasionally with the base and sides darker; head and pronotum black, more or less metallic, vertex broad, frontal sulci strong, subparallel, with a small impression at the base of each; antennæ pitchy, with the basal joints light underneath; pronotum with the globose part distinctly transverse, smooth and shining, strongly constricted before and behind; elytra more or less testaceous on their anterior part, with or without darker markings; behind the middle is a yellow band; the anterior testaceous colour may reach this or may be separated from it by a dark irregular band; posterior third dark, with the apex unicolorous or testaceous (the latter may be a sexual character); the punctuation is diffuse but strong, and gradually gets finer towards apex; on the posterior third it is sometimes more or less obsolete; legs variable, testaceous, with the posterior tarsi lighter, with dark claws, or with the anterior and intermediate tibiæ and tarsi pitchy, and the posterior tibiæ and tarsi whitish with the base of the former and the claws black; underside black or in part pitchy red, metasternum with traces of feeble sculpture.

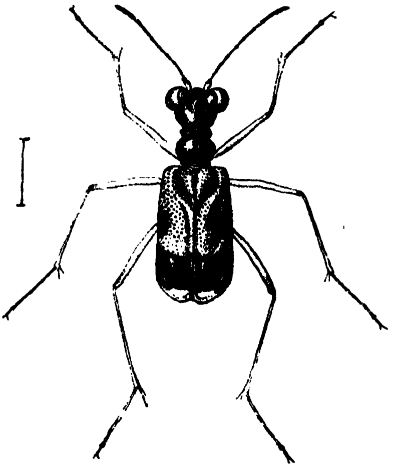

Fig. 136.—*Therates chenelli.*

Length 8½–9 millim.

Assam: Naga Hills, 2000 ft.; Burma: Karen Hills.

Length 8 millim. (7 mm. *sine labro*).

ASSAM: Khasi Hills; LOWER SIAM: Lakhon.

The variety differs from the type in having the orbits of the eyes more raised and straighter, and the intermediate portion of the pronotum narrower; the yellow humeral lunule is much longer (evidently extending beyond one-third of the elytra), and the basal spot is also larger and connate with the humeral spot; the discoidal central transverse yellow spot is slightly larger, and the apical fourth or fifth part of the elytra is indistinctly flavescent; the insect appears also to be a little larger than the type form.

Length 8–9 millim.

SIKKIM: Kurseong, Darjiling district, E. Himalayas, 5000 feet (*Annandale*).

Mr. Annandale found the species to be common in damp shady places, among shrubs and herbage, in June 1908.

Dr. Horn says that the anterior half of the elytra shows exactly the same pattern as *Therates kraatzi*, W. Horn, from Penang, but the discoidal patch of the latter is much larger; on the other hand, the apex of the elytra of the new form is much more broadly yellowish. There are differences also in the sulci on the front. The pronotum of *T. kraatzi* is broader than in the var. *annandalei*, and its extreme apex shows a distinct but slight transverse emargination.

80. **Therates waagenorum**, *W. Horn.*

Therates waagenorum, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 198.

A very small species which is most closely allied to *T. gestroi*, from which it differs in being smaller, with the head rather narrower and the longitudinal furrows near the orbits of the eyes deeper and more produced behind; the forehead between these is narrower and has two punctiform impressions behind; the whole pronotum is narrower and the central portion less globose; the markings of the elytra are similar. The species is also allied to *T. chenelli*, but differs in its smaller head and vertex, the latter being flat and slightly constricted before the anterior margin of the pronotum, which is transverse and narrow; the testaceous markings of the elytra are much the same; the lunulate mark at the shoulder is produced almost to the suture, follows the latter for a short distance, and then is confluent with the sutural part of the central patch, which is oblique; the apex of the elytra is indistinctly flavescent; the legs are for the most part light; the general colour, however, is variable.

Length 6½–7 millim.

SIKKIM: Darjiling; BURMA: Pegu; TENASSERIM.

I have not seen this species, but from the description it appears to be very closely allied to one or two neighbouring species, and to be somewhat hard to separate from them.

Subfamily CICINDELINÆ.

This subfamily contains upwards of seven hundred species which are distributed throughout the world, four genera being represented in the Indian fauna; one of these, *Apteroessa*, Hope, contains one very remarkable species, of which no perfect example exists, and which has not been found for more than a century.

Key to the Genera.

I. Mesosternum normal; wings rarely reduced (some species of *Prothyma*), nearly always complete and well developed.
    i. Underside entirely without pubescence* .... PROTHYMA, Hope, p. 300.
    ii. Underside with more or less pubescence.
        1. Underside practically without pubescence except for a distinct fringe of white hairs on the upper edge of the posterior coxal cavities; elytra parallel-sided with the apex, as a rule, conspicuously truncate obliquely.. HEPTODONTA, Hope, p. 310.
        2. Underside with variable but distinct pubescence, which is sometimes very scanty, but often thick or very thick and tomentose .... CICINDELA, L., p. 314.
II. Mesosternum with the episterna and epimera raised and projecting at their exterior hind margin; wings absent .... APTEROESSA, Hope, p. 440.

It is doubtful whether *Prothyma* and *Heptodonta* ought really to be separated from *Cicindela*; in any case there are species which are now included under the latter genus which appear to have as much right to be separated from it.

Genus PROTHYMA.

Prothyma, Hope, Col. Man. ii, 1838, p. 27.
Euryoda, Lacordaire, Mém. Liége, 1843, p. 107 (*ex parte*).
Jansenia, Chaudoir, Cat. Coll. 1865, p. 55 (*ex parte*).
Dromicidia, Chaudoir, Bull. Soc. Moscou, 1852, i, p. 21.

Type, *Cicindela quadripunctata*, Fabr.

The constitution of this genus is somewhat heterogeneous. Dr. Horn includes in it upwards of fifty species from Africa, Madagascar, India, the Malay region and China. The chief characteristic is the total absence of pubescence on the underside*; a few species have the wings much reduced. Two or three of the Indian species have been described on single specimens, and more knowledge concerning them is much to be desired.

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* Except in *Prothyma belloides*, Horn, a species described since this table was drawn up, and which ought perhaps to be referred to a separate genus.

Key to the Species.

I. Elytra very convex, with strong, close and regular scabrous punctuation throughout; length 13-16 mm; legs entirely red .... *scrobiculata*, Wied., p. 302.
II. Elytra moderately convex, or more or less depressed; sculpture less coarse and much less close, finer towards sides and apex than at base.
  i. Elytra with two white spots on the posterior half of each, one about middle, and the other before apex.
    1. Length not exceeding 13 mm.
      A. Pronotum transverse, rather strongly sculptured transversely; colour dark cyaneous; length 10½-12 mm. *proxima*, Chaud., p. 302.
      B. Pronotum not transverse, usually distinctly longer than broad, less strongly sculptured; length 9-10 mm.
        a. Forehead with concentric semicircular striæ .... *feae*, Gestro, p. 304.
        b. Forehead without concentric semicircular striæ.
          *a**. Elytra uneven, with distinct longitudinal furrows (more plainly visible in some lights than in others) .... *paradoxa*, W. Horn, p. 303.
          *b**. Elytra even, with at most an impression within the shoulder.
            a†. Length 9-10 mm.; sides of pronotum rounded; white spot at centre of elytra round.
              a‡. Elytra narrower, more deeply sculptured .... *inornata*, W. Horn, p. 305.
              b‡. Elytra broader, less deeply sculptured .... *limbata*, Wied., p. 304.
            b†. Length 13 mm.; sides of pronotum parallel; white spot at the centre of the elytra transverse. *reconciliatrix*, W. Horn, [p. 308.
    2. Length 17 mm.; colour dark coppery green, almost uniform; forehead flat with three impressions; legs very long and slender (? *Heptodonta*) .... *hennigi*, W. Horn, p. 308.
  ii. Elytra with three white spots (sometimes variable) on the posterior half of each.
    1. Form more robust; length 13½ mm.; the three white spots on the posterior portion of the elytra forming an equilateral triangle .... *schmidt-goebeli*, W. Horn, [p. 306.

2. Form more slender; length 10–12 mm.; the two anterior white spots situated close to one another.
    A. Form longer.................... *exornata*, Schm.-Goeb., [p. 305.
    B. Form shorter .... *bouvieri*, W. Horn, p. 307.

III. Form convex, elytra more strongly punctured on disc than at sides and apex, without white spots; size very small; apical ventral segments scantily pubescent .... *belloides*, W. Horn, p. 309.

81. Prothyma scrobiculata, *Wied.*

Cicindela scrobiculata, Wiedemann, Zool. Mag. ii, 1, 1823, p. 65.
Dromicidia scrobiculata, Chaudoir, Cat. Col. 1865, p. 54.

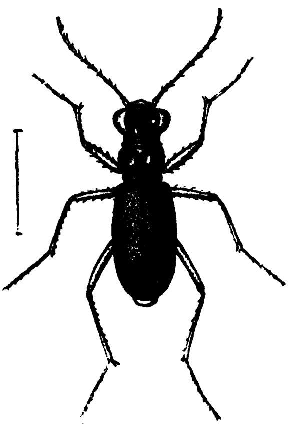
Fig. 137.—*Prothyma scrobiculata.*

A comparatively large, convex, scabrous looking species; upper surface obscurely metallic, with blue, green and bronze reflections, the sides of the head, pronotum and elytra being much brighter; labrum and antennæ (except towards apex) red; head large and broad, flat between the eyes, irregularly striate in front, finely and irregularly rugose transversely behind; pronotum convex, shiny, with the central line not strongly marked, deeply impressed in front and behind, with the anterior impression rugose, rather strongly rounded at sides, slightly narrowed before base, feebly sculptured; elytra very convex, regularly, closely and strongly punctured from base to apex, with the sides not dilated behind, and gradually rounded to the sutural angle, which is produced into a small point; legs entirely red; underside smooth and shining, bright blue or violaceous.

Length 13–14 millim.

BENGAL: Maldah (*Indian Museum*), Chota Nagpur, June–July.

This species has a peculiar facies and certainly looks as if it might be placed in a separate genus, but the characters do not seem sufficient to warrant its being regarded as distinct.

82. Prothyma proxima, *Chaud.*

Cicindela proxima, Chaudoir, Bull. Soc. Moscou, 1860, p. 325.

Upper surface of a dark cyaneous or dark blue colour, with the front parts dark green or almost black, and with the sides of the elytra more brightly coloured in some specimens; labrum testaceous in the centre in the male, unicolorous in the female; head almost flat between the eyes, irregularly striate throughout, the striations forming wavy lines; pronotum more or less transverse with the sides not or scarcely rounded, and the central line more or less distinct, sculptured much as the head, but transversely and more strongly; elytra strongly punctured at base, less closely, though distinctly, behind, the sculpture being somewhat rugose in places, with the shoulders well marked, and with traces of a short broad furrow between shoulders and suture; on each there are two whitish spots, one just behind middle and one before apex; underside and femora metallic blue or green, tibiæ and tarsi more or less pitchy.

Length 10½–12 millim.

SIKKIM: Kurseong (*Fleutiaux*); BENGAL: Calcutta, Birbhum (*Ind. Mus.*); CENTRAL PROVINCES: Nagpur; BOMBAY: Dharwar, Kanara (*Bell*); MADRAS: Ramnad, Cocanada.

The elytral spots are very much smaller in some specimens than in others and almost obsolete, but I have not seen enough examples to decide whether this is a sexual difference.

83. **Prothyma paradoxa**, *W. Horn.*

Cicindela paradoxa, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 75.
Prothyma paradoxa, W. Horn, Spol. Zeyl. ii, 1904, pl. 7. fig. 5: Maindron, Ann. Soc. Ent. France, 1905, p. 9, pl. 1, fig. 2.

A dull dark brown species, with slight greenish or æneous reflections on the head, but almost unicolorous; labrum metallic with the centre broadly whitish in the male, uniformly dark testaceous in the female (this may be variable); head scarcely excavate, with fine, but well marked, orbital striation, and with the vertex very closely sculptured; pronotum longer than broad, somewhat rounded behind and contracted in the male, almost parallel-sided in the female, central line well marked, upper surface very finely sculptured, dull; elytra rather more shining, with one or two more or less obsolete broad longitudinal furrows which make the surface look irregular, punctuation distinct throughout, but considerably stronger towards base; on each just behind middle there is a small round whitish spot at about an equal distance from the suture and margin, and another, larger and less regular, a little before apex near margin; legs more or less pitchy with the femora metallic, knees sometimes testaceous; underside shining, cyaneous, greenish, or violaceous.

Length 9–10 millim.

BOMBAY: Kanara (*Bell*); MADRAS: Mahé (*Maindron*), Trivandrum (*Ind. Mus.*); CEYLON: Pondicherry.

Dr. Horn says that there is one furrow on the elytra of the male from which he described the species; in the only male I have seen there are distinct traces of two; in the female only one; they are indistinct but may be plainly seen in certain lights and are very characteristic of the species.

Does not fly by day; runs swiftly on wet, short-grassed and open places; comes to light in the evening, seems to fly after dark (*Horn*).

84. Prothyma limbata, *Wied.*

Cicindela limbata, Wiedemann, Zool. Mag. ii, 1, 1823, p. 64.
Euryoda tetraspilota, Chaudoir, Bull. Soc. Moscou, 1852, p. 29.

A shining and brightly coloured little species, crimson or with a violaceous tinge, with the scutellum, and the suture, shoulders, sides and apex of the elytra green, or bright blue, these colours being also more or less present on the vertex and margins of the pronotum; head between the eyes feebly excavate with very strong striæ which appear to reach further back in the male than in the female; antennæ pitchy, with the base metallic; pronotum subquadrate, very slightly narrowed behind, with the sides very gently rounded, and with the central line often more or less obsolete and the upper surface very finely transversely sculptured; elytra with the shoulders well marked, strongly punctured at base and more finely towards apex, parallel-sided in the male, somewhat widened behind in the female, with two very distinct, almost equal-sized, white spots on each near the margins, one just behind middle and one before apex; legs more or less metallic green or black, tibiæ and tarsi, for the most part, pitchy; underside shining, bright blue or violaceous.

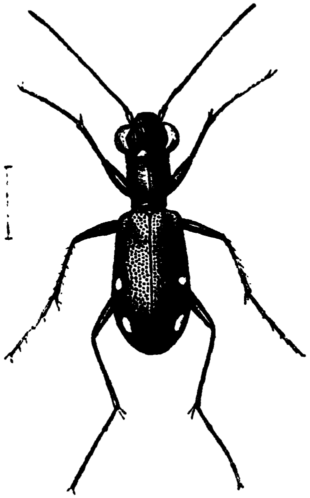

Fig. 138.—*Prothyma limbata.*

Length 9–10 millim.

BENGAL: Calcutta; PUNJAB: Jhelum Valley, Simla.

In the only specimens I have seen, the male, besides having the elytra parallel-sided and not widened behind, has the labrum white with the margins metallic; in the female the labrum is unicolorous dark metallic.

85. Prothyma feæ, *Gestro.*

Cicindela feæ, Gestro, Ann. Mus. Genova, 1889, p. 88.

A smooth green metallic species, with the disc of the elytra cyaneous purple, and the suture golden coppery; each elytron has on its posterior half two smooth oval whitish spots, arranged one behind the other near the lateral margin; labrum whitish in the middle in the male, entirely bronze-green in the female; head with deep parallel longitudinal striæ between the eyes, and with concentric semicircular striæ on the forehead; pronotum rather narrow, with hardly any traces of transverse folds; legs metallic green, with the tibiæ and tarsi coppery; underside glabrous, cyaneous, green in the middle.

Length 9 millim.

BURMA: Teinzo, Bhamo (*Fea*, May and June).

I have not seen this species, which appears to be in great measure distinguished by the sculpture of the head. According to Gestro, it is most closely allied to *P. quadripunctata*, Fabr. (from Java), the type species of the genus, but differs in being smaller and differently coloured, with the sides of the pronotum less rounded, and in the different sculpture of the head and pronotum.

86. **Prothyma inornata**, *W. Horn.*

Rhytidophæna limbata, Bates (*nec* Wied.), Entomologist, 1891, Suppl. p. 7.
Euryoda inornata, W. Horn, Deutsche Ent. Zeitschr. 1899, p. 368.
Prothyma inornata, W. Horn, op. cit. 1905, p. 13.

Allied to *Euryoda* (*Cicindela*) *limbata*, Wied., and *E. feæ*, Gestro, but very different in colour, and with the pronotum angular in the middle and its sides more rounded: from the former species it differs in its narrower elytra which are a little more deeply sculptured; and from the latter in its more robust form, shorter labrum, broader head and pronotum (the latter being also more narrowed at the base), and more ample elytra, which are more dilated behind the middle. The colour of the upperside is obscure coppery bronze with an admixture of dull purple, moderately shiny, the forehead and pronotum being a little brighter; the sides of the head, pronotum and elytra are bronze-green with here and there a little cyaneous colour, and the anterior and posterior margins of the pronotum and the very narrow suture of the elytra, as well as the apical margin, are greenish bronze; the underside is shining green, with the episterna cyaneous and the legs bronze.

Length 10 millim.

PUNJAB: Kulu; ASSAM.

The colour in these metallic species is often very variable, so that in the above description, based on one specimen, the account of the colour must be taken with some reservation.

P. inornata and *P. feæ* are very probably subspecies of *P. limbata.*

87. **Prothyma exornata**, *Schm.-Goeb.*

Prothyma exornata, Schmidt-Goebel, Faun. Col. Birm. p. 1, pl. 1, fig. 7.

Rather long, cylindrical and parallel-sided, of an obscure coppery bronze colour with brighter reflections in front, with the sides of the head and pronotum and of more or less of the elytra bright cyaneous blue and green; labrum very large and prominent, raised in the middle, strongly toothed, varying in colour; antennæ rather long, slightly thickened towards apex, pitchy, with the base metallic; pronotum long, subcylindrical, striate transversely; elytra parallel-sided, with the shoulders and the impression between them and the suture well marked, strongly punctured at base, more finely behind, very finely, but distinctly, at apex; just behind the middle, almost touching the margin, is a rather large whitish spot, with another smaller one just behind it nearer the suture, and before the apex there is another rather large spot of the same colour at the outer angle; the small humeral spot appears to be very minute or obsolete in this species; underside greenish or bluish; femora metallic (green or bluish and more or less golden), trochanters and knees red or reddish, tibiæ and tarsi reddish or pitchy red.

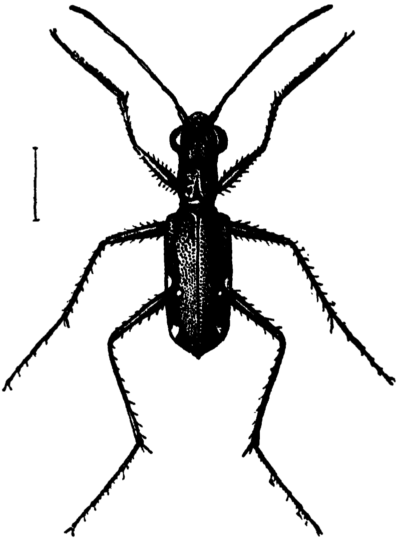

Fig. 139.—*Prothyma exornata.*

Length 10–12 millim.

Burma: N. Chin Hills, Karen Hills, Tharawaddy (*Corbett*), Pegu district; Annam; Cambodia.

Schmidt-Goebel described the species from a single small female specimen of uncertain locality.

An example of this insect in the British Museum has the labrum black and not testaceous as in Schmidt-Goebel's description; in a specimen which I have before me it is dark testaceous. Differences of this kind are sometimes sexual, but in this case both specimens are females.

88. **Prothyma schmidt-goebeli,** *W. Horn.*

Euryoda schmidt-goebeli, W. Horn, Deutsche Ent. Zeitschr. 1898, p. 87.

Very closely allied to *P. exornata*, Schm.-Goeb., but differs in its more robust build, evidently thicker head, and more convex and thicker pronotum, which has the anterior and posterior impressions deeper and the sculpture a little sharper; the elytra are wider with the impressions less evident and almost absent; the sides of all the sterna are smooth; the colour of the upper surface is a brighter copper, more shiny, and the whole margin of the elytra from the shoulders to the posterior white spot is bright cyaneous; in the single female specimen described by Dr. Horn the whitish spots are arranged as follows: one, very small, at the shoulder, another near the margin at middle, a third situated at the side of and behind this, at a much greater distance than is the case with the third spot in *P. exornata*, and a fourth near margin at apex; the third spot is at about an equal distance from the second and fourth and forms with them an equilateral triangle; according to Dr. Horn there is no humeral spot in the female in *P. exornata*, but there is a specimen in the Calcutta Museum in which a very small one is present. The palpi (with the exception of the last joint) and the trochanters are yellow; the posterior femora are entirely without hairs.

Length 13½ millim.

BURMA; CAMBODIA: Laos.

Mr. H. E. Andrewes has lent me a specimen of this insect labelled "Goktaik, vi. 10," taken by Mr. H. Leslie Andrewes and named by Dr. Horn; the apical white spots are very conspicuous, but the only other marking is a very small white spot just behind the middle of the left elytron.

89. **Prothyma bouvieri**, *W. Horn.*

Euryoda bouvieri, W. Horn, Bull. Mus. Hist. Nat. Paris, 1896, p. 328.

Allied to *P. exornata*, Schm.-Goeb., but with the labrum shorter, the forehead and pronotum broader, and the sides of the latter more rounded; the elytra are less elongate with the apices more obliquely truncate; the sculpture is slightly closer, and the impressions are more strongly marked; the punctures near the suture in the middle are transversely confluent; the marginal spot behind the middle is very much smaller and scarcely visible, the discoidal one being larger and more approximate; the upper surface is coppery and less shining.

Length 10½–11 millim.

BURMA: Maymyo (*H. L. Andrewes*), Lakhon (*Harmand*).

Dr. Horn says that this species possesses two yellowish spots in the centre of the elytra like *P. exornata*, *P. schmidt-goebeli*, and *P. heteromalla*, but these are more approximate to one another and the lateral one is much smaller than the one on the disc. The species is more robust and shorter than *P. exornata*, especially as regards the elytra, which are also more oval.

I have before me the specimen taken by Mr. H. L. Andrewes; the lateral spot is quite wanting and the other spot behind the middle can hardly be called discoidal and is comparatively large and elongate. Were it not for the label attached in Dr. Horn's writing, I should be inclined to consider it a different insect from the one described by him as *E. bouvieri*, as, apart from the spots, the elytra, though short, are parallel-sided and not ovate.

90. **Prothyma reconciliatrix**, *W. Horn.*

Euryoda reconciliatrix, W. Horn, Deutsche Ent. Zeitschr. 1900 p. 200.

A comparatively large and robust species; larger than *P. exornata*, with a larger head, more developed orbits and different sculpture of the front; the pronotum is more parallel-sided and less narrowed behind; the elytra are broader, and the whitish spots are different and arranged as follows:—one, minute, at the shoulder; a second, in the middle, more or less transverse; and a third, at the apex, round, the two latter being rather large; the sides of the elytra are broadly blue, and the anterior part between the sides and disc is bright golden; the penultimate joint of the maxillary palpi is yellow, and the knees are testaceous; the underside is brightly coloured.

Length 13 millim. (12 mm. *sine labro*).

BENGAL: Dacca (*Bowring*); TENASSERIM.

Dr. Horn compares this species, which he has described from one female specimen, with *E. heteromalla*, McLeay, to which it appears to be most closely allied. The latter species, however, does not occur in our region, being confined to Malacca and the Malay Archipelago.

91. **Prothyma hennigi**, *W. Horn.*

Heptodonta or *Euryoda* (?) *hennigi*, W. Horn, Ent. Nachr. xxiv, 1898, p. 177.

A large species with the head and pronotum dark coppery green, and the elytra of much the same colour, moderately shining; the orbital parts are bluish, and the whole underside is cyaneous or greenish cyaneous; the forehead is flat in the middle and has three impressions, the central one being the most distinct; the pronotum has the central portion globose-ovate, with the central line distinct, the apical part transversely striolate, and the middle and basal parts very finely sculptured; on each elytron there are three spots, one at the shoulder, very small, another at middle and a third before apex, the two latter being at a little distance from the margin; the palpi are black; the legs are very long and slender, dark, with the basal and central parts of the femora red; the anterior tarsi are much longer, and the posterior tarsi a little longer than the tibiæ.

Length 17 millim. (15½ *sine labro*).

ASSAM: Khasi Hills.

This is a somewhat abnormal species and ought, perhaps, to be referred to *Heptodonta*. Dr. Horn has placed it provisionally in both genera; the fringe of hairs on the outside free margin of the posterior coxæ, which is one of the chief characteristics of the genus *Heptodonta*, appears to be absent; but the question can hardly be decided on one example. In seems to be a very distinct insect.

92. **Prothyma belloides**, *W. Horn.*

Prothyma belloides, W. Horn, Ann. Soc. Ent. Belgique, 1907, p. 311.

This is a very small species which Dr. Horn describes as differing from all the other species of the genus in having the last ventral segments of the abdomen clothed with short and sparse greyish pubescence; this character, however, does not always appear to be very evident. He compares it with *Odontochila rothschildi*, W. Horn, which it resembles in size, and with *Cicindela belli*, W. Horn, with which it agrees in convexity, sculpture, and the variegated sheen of the upper surface. The general colour is cyaneous black, with more or less of the front parts and the sides bright cyaneous, and on the elytra there are sometimes two or three greenish-cyaneous hook-like branches proceeding from the sides to the disc and more shining than the surrounding surface; these, however, are not evident in the only specimen I have seen; labrum large, metallic cyaneous-black; eyes very prominent; head rather long behind the eyes, finely shagreened and rather dull; pronotum sculptured much as head, longer than broad, with the sides almost straight, the transverse furrows moderately developed and the central longitudinal furrow distinct, though not strongly marked. Elytra parallel-sided, convex, shining, strongly punctured in front, almost smooth behind; sutural angle without any visible spine; underside glabrous, cyaneous; antennæ blackish; palpi slender, testaceous (except the last joint of the labial palpi and the last two joints of the maxillary palpi, which are metallic black); legs and trochanters yellowish, apex of tibiæ, knees and all the tarsi dark.

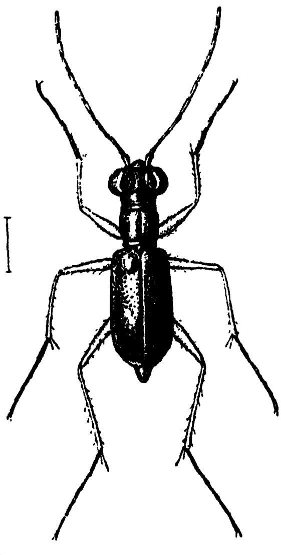

Fig. 140.—*Prothyma belloides.*

Length 5½–6 millim.

Bombay: Kanara (*T. R. D. Bell*).

Dr. Horn remarks that this little species is one of the most interesting of those belonging to the genus *Prothyma*, as it is the most aberrant species of the genus, and presents points of important phylogenetic significance.

Genus **HEPTODONTA**.

Heptodonta, Hope, Col. Man. ii, 1838, p. 22; Lacordaire, Gen. Col. i, p. 21.

Type, *Cicindela analis*, Fabr.

This genus is characterised by the long parallel-sided elytra and their conspicuously oblique apices, and also by the fact that the underside is practically glabrous, except for a distinct fringe of white pubescence on the anterior edge of the posterior coxal cavities; the labrum, as a rule, has seven distinct teeth; the wings are never reduced; in the male the intermediate, as well as the anterior, tarsi are dilated.

The genus contains about fifteen or eighteen species, which appear to be chiefly confined to India, the Malay Peninsula, and Indo-China; one species occurs in the Philippines and one has been recorded doubtfully from Hong-Kong. Five species occur within our area.

Key to the Species.

- I. Pronotum transversely globose; sculpture of elytra rugose to apex, the wrinkles being very strong and confused, running in different directions. *nodicollis*, Bates, p. 311.
- II. Pronotum not transverse, usually distinctly longer than broad.
  - i. Sculpture of elytra much finer towards apex, rugose, but with the wrinkles less close together, shorter than in *H. nodicollis*, and never oblique.... *kraatzi*, W. Horn, p. 312.
  - ii. Elytra punctured, with the punctures somewhat confluent in parts towards base.
    - 1. Length 15-17 mm.; upper surface duller, with finer sculpture .... *pulchella*, Hope, p. 312.
    - 2. Length 10-12 mm.; upper surface more shiny, with coarser sculpture especially towards base.
      - A. Pronotum with the sides rather strongly rounded, subglobose .... *eugenia*, Chaud., p. 313.
      - B. Pronotum with the sides scarcely rounded, almost straight...... *arrowi*, W. Horn, p. 313.

93. Heptodonta nodicollis, *Bates.*

Pronyssa nodicollis, Bates, Ent. Monthly Mag. x, 1874, p. 267.

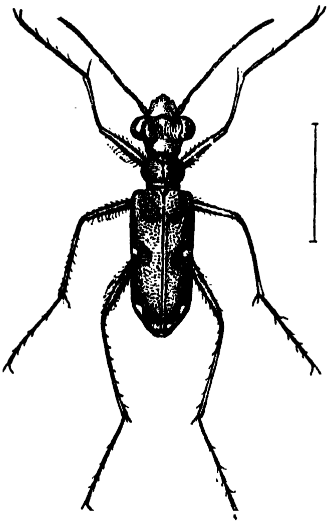

Fig. 141.—*Heptodonta nodicollis.*

A bright, shiny, golden green, elongate and graceful species; head large, longer than the pronotum; labrum very long, covering the mandibles except the apices, with five distinct teeth and traces (sometimes obsolete) of two others at the sides, green with broad testaceous margins in the male, entirely green in the female (this may be a variable character); antennæ fuscous with the base metallic, palpi testaceous with the apex dark; the space between the eyes is concave and the whole head is very finely and closely striate; pronotum subglobose, transverse, triangularly compressed in front and behind, the impressions being æneous, upper surface finely rugose transversely; elytra with the shoulders well marked and with a furrow on each side internally, the space between being raised; the space before apex is depressed but not so strongly as in *H. pulchella*; the sides are parallel until a little before the apex and are then obliquely truncate, the apex is truncate, and the internal angle ends in a small tooth; on each there are three white spots close to, but not touching the margin, one at the shoulder, distinct in the male, obsolete in the female, one just about the middle, and one, more or less irregular, before the apex; the sculpture consists of irregular rugose striæ, which are well marked throughout, and the interstices are raised and shiny, giving the insect a frosted appearance when fresh; legs red, with the knees and part of the anterior femora pitchy; in the male the first three joints of the anterior and intermediate tarsi are dilated and pilose; underside bright green with golden reflections.

Length 13–15 millim.

SIKKIM: Darjiling, Mungphu, Kurseong (Indian Museum); ASSAM: Khasi Hills (Oxford Mus.).

Horn (D. E. Z. 1892, p. 94) proposed to place this species in a new genus *Tetreurytarsa*, but has since placed it under *Heptodonta*; there can be no doubt but that it belongs to the latter genus and that it cannot be separated from it.

94. Heptodonta kraatzi, *W. Horn.*

Heptodonta kraatzi, W. Horn, Deutsche Ent. Zeitschr. 1899, p. 54.

Allied to *H. nodicollis*, from which it may be known by its longer and not transverse pronotum, which is almost smooth; the shoulders are a little narrower and the elytra less unevenly impressed, with the rugose sculpture much less close and the wrinkles shorter; the whole upper surface is bluish green, rather shining, with the sides mostly blue; apparently there are no white spots as in *H. nodicollis.* The female only is known.

Length 13½–14 millim. (12–12½ mm. *sine labro*).

Sikkim: Mungphu, Darjiling (Indian Museum); Assam: Khasi Hills.

95. Heptodonta pulchella, *Hope.*

Cicindela pulchella, Hope, Gray's Zool. Miscell. 1831, p. 21.
Cicindela hopei, Parry, Trans. Ent. Soc. Lond. 1845, p. 84.
Cicindela variipes, Chaudoir, Bull. Soc. Moscou, 1850, p. 11.
Heptodonta ferrarii, Gestro, Ann. Mus. Genova, 1893, p. 366.

A large, dull, olive-green species, sometimes with an obscure æneous reflection; labrum large, testaceous, with seven distinct teeth, jaws and palpi testaceous with black apex; head very finely sculptured, antennæ pitchy, with base metallic; front more or less obscurely impressed between the eyes; pronotum subquadrate, with the sides rounded and somewhat contracted before base, central line distinct, impressed angularly in front and behind, so that the whole central portion is apparently raised and rounded off in two portions, sculpture very fine and close, sides almost smooth, shining; scutellum rather large; elytra with the shoulders well marked, and with a distinct short longitudinal impression just inside them, sides quite parallel and straight from shoulders to a little before apex, from whence they are obliquely truncate, apex itself truncate, interior angle ending in a distinct tooth; before the apex the elytra are strongly impressed, the part before the impression being much raised; the sculpture is very fine, but distinct throughout, and gives the insect a very finely shagreened appearance; legs red, with a ring before apex of the femora, part of the tibiæ, and the tarsi black, or the femora may be dark with a red ring before apex; they are, however, variable; underside brilliant cyaneous or green, with or without golden reflections. In the male the anterior tarsi are strongly dilated and pilose beneath, and the intermediate tarsi are also, though less strongly, dilated and pilose.

Length 15–17 millim.

Sikkim: Mungphu, Darjiling; Nepal; Burma: Karen Hills (*Fea*); S.W. China: Yunnan.

H. ferrarii, Gestro, appears to be only a smaller and duller variety of this species, with the pronotum slightly longer; it was found in the Karen Hills.

96. Heptodonta eugenia, *Chaud.*

Heptodonta eugenia, Chaudoir, Cat. Coll. 1865, p. 56; Gestro, Ann. Mus. Genova, 1889, p. 87.

A very pretty, elongate, parallel-sided species, with the front parts bright blue or greenish blue, and the elytra coppery with strong greenish reflections; sides of the whole body brilliant cyaneous; labrum elongate, produced, strongly toothed, dark; maxillary palpi with the base testaceous and the last two joints dark, labial palpi testaceous with the apical joint dark; head long, excavate and striate between the prominent eyes, finely sculptured behind; pronotum longer than broad, with deep impressions in front and behind, central portion subglobose, finely sculptured transversely in the middle, somewhat rugosely at the sides; scutellum large, coloured as pronotum; elytra long and narrow, parallel-sided, subcylindrical, strongly impressed between shoulders and suture and before apex, closely and distinctly punctured throughout, the punctation being somewhat rugose in parts; femora and trochanters clear red, knees dark, tibiæ partly red, the remainder of the legs fuscous; underside green and cyaneous, smooth, glabrous and shining, episterna of metasternum feebly sculptured.

Length 11–12 millim.

Burma: Teinzo, Bhamo, and between Yenang-Yaung and Mandalay (*Fea*), Tharawaddy (*Corbett*).

97. Heptodonta arrowi, *W. Horn.*

Heptodonta arrowi, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 362.

Very closely allied to *H. eugenia* and chiefly distinguished by the less globose pronotum, which is more evidently striated; the colour is more bronze and less green and the sculpture of the elytra (which are a little flatter) is slightly finer and less rugose; the sides of the whole body are brilliantly metallic, the colour being cyaneous at the margins and between these and the disc green; the underside is green, in part cyaneous; the palpi, except the apex, the trochanters, coxæ (for the most part), femora and half the tibiæ are red, the rest of the legs and the tarsi dark.

Length 11–12 millim.

Burma: North Chin Hills; Tenasserim: Tavoy (*Bingham*).

The labrum is less produced than in *H. pulchella*, the eyes are more prominent, and the sculpture of the front parts is coarser, and the elytra are a little more finely and thickly sculptured than in that species, which is also much larger.

Genus CICINDELA.

Cicindela, Linné, Syst. Nat. ii, 1735, p. 657; Lacordaire. Gen. Col. i, 1854, p. 17.

Type, *Cicindela campestris*, Linné.

This is by far the largest and most important genus of the family. The species are very variable in size and colour, but they bear a strong superficial resemblance one to the other, and even the most obscure among them cannot be confounded with the members of any other family. The following are their chief characteristics:—

Head large, more or less excavated and nearly always more or less striated between the eyes, which are large and, as a rule, very prominent; antennæ long, filiform, with the basal joints metallic or shining, and the apical joints dull; labrum usually large, but never covering the whole of the mandibles as in *Therates*, sometimes considerably reduced and leaving the greater part of them exposed; mandibles large and powerful, with strong and sharp teeth; labial and maxillary palpi much resembling one another, slender or comparatively slender, the penultimate joint of the former very long; mentum with a strong sharp central tooth; pronotum usually quadrate or subquadrate, sometimes transverse, sometimes longer than broad, but not markedly so, with or without setæ, which are often present at the sides, and sometimes invade the upper surface; scutellum usually well developed; elytra very variable, but always considerably broader than the pronotum, and, as a rule, with the shoulders well marked; the sutural apical angle often terminates in a small sharp spine; the underside is more or less brilliantly metallic, with pubescence varying from a few scattered hairs to a tomentose covering which conceals the whole except just in the centre; the legs are long, or very long, and very slender, and the posterior coxæ are large and strong, with the trochanters well developed.

The sexes are easily distinguished by the fact that the male has the first three joints of the anterior tarsi (and rarely of the intermediate tarsi as well) dilated and pilose or spongy-pubescent beneath; in the female they are simple. It is very probable that good characters will hereafter be found in the apophyses (or gonapophyses as they are sometimes called) of the genital segments of the female; these are very variable, but the last dorsal sclerite is often furnished with hook-like processes resembling those of the COLLYRINÆ; they differ, however, very considerably, and are often more or less hidden. The small sharp processes which are found on the posterior margin of the last ventral segment in *Collyris* are apparently wanting, but the margin is usually cleft and a pointed process is left on each side which is utilised in ovipositing.

The species of *Cicindela* are apparently seldom arboreal, like those of *Collyris* and *Tricondyla*, but several exceptions occur. Westwood, for instance (Modern Classif. Insects, i, p. 49), says:— "In the warmer climates of the New World some of the species of *Cicindela*, *Iresia*, *Euprosopus*, &c., appear to lose some of the habits of their congeners of more moderate climes, since it is upon the leaves and trunks of trees that they are generally found, where, like their terrestrial relatives, they carry on a ferocious war against other insects, flying from leaf to leaf with the agility of flies, and darting upon their prey with great quickness." Mr. H. Leslie Andrewes has also observed in the Nilgiri Hills, India, that *C. hamiltoniana* and the recently described *C. venus* are semi-arboreal in their habits. A few species, in which the legs are extraordinarily developed, appear to be able to proceed on the water from one aquatic plant to another, but as a rule they are attached to sandy places either inland away from water, or on the margins of rivers, or near the sea; in the latter case, either on sand-hills or on the sea-shore itself. They are extremely active and often very difficult to capture, as they run with great swiftness and very quickly take to flight; these flights are not long, but sufficient to take them beyond the reach of a pursuing enemy, and on alighting they very swiftly run to a place of safety and concealment. They are all very rapacious. The most brilliant species, in spite of their colours, are not nearly so conspicuous as might be expected, as they are usually more or less in harmony with their surroundings; in many cases the duller and less brilliantly coloured species closely resemble their environment, especially those which have the elytra of a light sand-colour with darker markings. Mr. H. C. Robinson, whom we have already quoted, gives the following note by Dr. Annandale on *C. aurulenta*, Fabr. (Fasc. Malay. i, 1903, p. 172):—"This wide-spread species was common everywhere in open country in the Siamese Malay States from sea-level (though its place was taken on the shore by *C. sumatrensis*) to 3000 feet, but we did not ourselves meet with it in Perak or Selangor. In habits it exactly agrees with those of *C. campestris*, being found running with great rapidity along roads or on patches of damp or dry sand, often in the hottest sunshine, and readily making use of its wings when disturbed. The mode of flight and the dense white pubescence of the lower surface * give the insect a close resemblance to certain of the smaller wasps, which it resembles also in the buzzing sound it produces when handled. Its variegated colour, however, renders it inconspicuous in broken light when on sand strewn with scattered leaves and twigs." He further quotes Mr. Ridley, who, in a paper published in the Proceedings of the Straits Branch of the Royal Asiatic Society, says that "the Tiger Beetles of the Malay Peninsula fall very readily into two divisions, those which, like our European species, are essentially denizens of the open country or of the sea-shore, and those which are exclusively found in the jungle. To the latter section great interest attaches, for they act as models which are imitated by large numbers of other insects, more especially by beetles and certain Orthoptera."

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* *C. aurulenta* is not strongly pubescent on the underside compared with many other species, but this observation shows how conspicuously the pubescence at the sides must appear in flight.

The life-history of two or three of the species belonging to the genus is well known, but I am not acquainted with the larva of any Indian species; so far as is known, they all make burrows in which the larva dwells, feeding on the insects that fall in or approach the entrance.

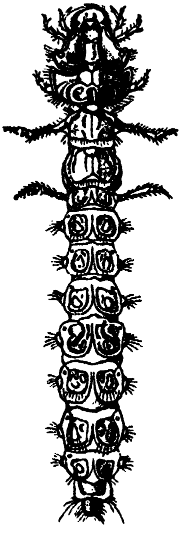

Fig. 142.—Larva of *Cicindela hybrida*. (After Schiödte).

The larva of *C. hybrida*, L., is described and figured by Schiödte (De Met. Eleuth. i, p. 160, pl. xii, figs. 1–16). It is of a whitish colour, with the front parts darker; the head is very large, broader than any of the other segments of the body, with powerful mandibles; like the larva of *C. campestris*, L., it is chiefly characterized by the presence of two powerful hooks on the upper surface of the fourth abdominal segment, which enable it to move rapidly up and down the perpendicular sides of the burrow; the legs are formed for digging; the anal appendage is short and small, as long as broad, and there are no cerci. The pupa of *C. campestris* is also described and figured by Schiödte (*l. c.* p. 262, pl. xii, fig. 7); it is parallel-sided until a little before the apex, where it contracts into a blunt point, terminated at the apex on each side by two minute projections which are probably rudimentary cerci; it is chiefly characterized by two long corneous appendages, one on each side of what appears to be the fourth abdominal segment; these correspond, apparently, to the two larval hooks before referred to. The rough figure of the larva of *C. campestris* given by Westwood (Mod. Classif. Insects, i, p. 48, pl. i, fig. 7) gives a better idea of the general conformation and habit of a *Cicindela* larva than the more elaborate figure of Schiödte. It is much to be hoped that observers of the group will pay more attention to life-histories and habits than to simple collecting, as a good observation and note is much more valuable than a good insect.

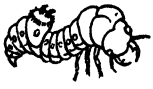

Fig. 143.—Larva of *Cicindela campestris*. (After Westwood.)

A valuable paper, "On the Life-Histories and Larval Habits of the Tiger Beetles," by Victor E. Shelford, has recently appeared in the Journal of the Linnean Society (vol. xxx, March 1908, pp. 157–182, pls. 23–26). Mr. Shelford has taken great pains in rearing several species taken near Chicago, and has paid particular attention to the life-history of *Cicindela purpurea*, Ol. As his paper is not generally available it may be well to quote some of the chief points which he notices.

In the first place he describes the oviposition of the female in detail. The ovipositor is made up, he says, of the abdominal segments 8, 9, and 10 and their appendages. The posterior part of the seventh and the anterior part of the eighth segments are soft and pliable, serving to permit the entire posterior end of the abdomen to be withdrawn into the segments in front, as is the case in many Coleoptera. The apical appendages or "gonapophyses," of which he gives an elaborate description, are used by the female for digging holes in the ground from 7 to 9 mm. in length. She tries the soil at first by making holes without laying eggs, but afterwards lays single eggs in these holes, with the larger end uppermost. In about two weeks after the eggs are laid the young larvæ appear, being much like their later stages. Soon after hatching, the larva makes its way to the surface, packing the soil so that the diameter of the burrow is only slightly broader than its prothorax; at first the burrow is no deeper than the hole made by the ovipositor, but the larva soon digs to a depth of 10 to 15 cm. After feeding for three or four weeks, the larva closes the mouth of the burrow with soil, and goes to the bottom and moults, returning again to the surface at the end of from five to seven days. The second larval stage lasts about five weeks, and the third and last is much the same as the others. The pupa at first is only a little shorter than the larva, but it gradually contracts and assumes a form broad in front and tapering to the apex; the large mandibles of the perfect insect are strongly marked, and the back is furnished with long tubercles, each ending in three setæ, which serve to keep the body away from the surface on which it rests. "The eggs of the species (*C. purpurea*) are laid in May: the larvæ reach their last stage in August, hibernate, begin to feed again in April, and pupate in July; the adults emerge in August, feed for a time, hibernate, and come out in the second spring still sexually immature, reach maturity in the first warm days of April, and lay eggs and die. The larval life lasts from twelve to thirteen months, and the adult life ten months—two years between generations."

Mr. Shelford further gives valuable notes on about a dozen American species, and sums up as follows:—

"1. The eggs are laid in open burrows made by the ovipositor as in the English species; the period of incubation is usually about two weeks.

"2. There are three larval stages; the first usually lasts a little more than one month, and the others vary greatly in different species.

"3. The burrows differ greatly in different species; *C. generosa* has a burrow which opens into the side of a pit, an adaptation to shifting sand; *C. cuprascens* does not smooth the edge of the burrow in the usual manner.

"4. The life-histories are of three types:—

(*a*) Eggs laid in the late spring or early summer; larvæ hibernate usually in the third stage, pupate in the second summer; imagos emerge about a month after pupation, hibernate, and become sexually mature late in the third spring; larval life lasts twelve to thirteen months, adult life ten months — two years between generations.

(*b*) Eggs laid in midsummer: larvæ hibernate usually in the third stage, pupate in the following June; the imagos emerge in early July, and become sexually mature very soon; larval life ten months, adult life two months—one year between generations.

(*c*) Eggs laid in midsummer; larvæ hibernate in the second stage, reach the third stage early in the second summer, hibernate again, and pupate in the following May; imagos emerge in the early part of third summer, and become sexually mature soon; larval life twenty-one months, adult life two months — two years between generations.

"5. Temperature, moisture, and food influence the length of the different stages.

"6. Pigmentation and final hardening of the cuticula take place in the pupa in those parts which are employed in the final ecdysis, and the bristles of the imago assist in the removal of the exuvium.

"7. The generations frequently overlap; of importance in connection with colour-changes.

"8. The habits and responses of the imagos and larvæ bring about great difference in the environmental conditions of different individuals of the same brood."

We have given the above at length, for the paper, as we said before, is not very accessible to students, and the comparison of the life-history of any of the tropical species with that given above is likely to prove very interesting. We are glad to say that Mr. Shelford is still continuing his researches, and has promised further papers on "distribution, variation, the effects of varying environmental conditions during development, an analysis of the colour-patterns, a discussion of race-tendencies of the genus *Cicindela*, and the bearing of the whole on the problem of evolution."

Dr. W. Horn, in his recently published "Systematischer Index der Cicindeliden" (Deutsche Entom. Zeitschr. 1905, p. 556), arranges the species under their different regions. Some doubt may be felt with regard to the specific value of some of the species, but approximately they are distributed as follows:—

1. The Neotropical region, including South America, Central America as far as Nicaragua (inclusive), and the islands of the West Indies: about fifty species (not including subspecies).
2. The Nearctic region, including Canada, the United States,

Mexico, and the Central-American region as far as Honduras (inclusive): about one hundred species.

3. The Palæarctic region, including Europe, Palæarctic Asia, Japan, and the north of Africa: about seventy species, some of which are extremely variable. *C. hybrida*, L., for instance, as at present constituted, includes twenty-two subspecies and varieties, while *C. campestris*, L., includes twenty, and *C. germanica*, L., twelve.
4. The Indian region, including the whole of the region with which we are dealing in this work, and also the western part of the Malay Archipelago, as well as Siam, Tonkin, Southern China, and the Philippine Islands: about one hundred and seventy-five species, of which about one hundred and ten occur in our region.
5. The Australian region, including Australia, New Zealand, New Guinea, and the adjacent islands: about sixty species.
6. The Æthiopian region, including Africa (except the circum-Mediterranean region) and the adjacent islands, especially Madagascar: about one hundred and thirty species.

Various attempts have been made towards some sort of classification of this mass of species belonging to one genus, upwards of six hundred in all, but up to the present time with very unsatisfactory results, as, whatever characters are adopted, there are always intermediate forms.

The following groups are those which have been adopted by Dr. Horn, and I am chiefly indebted to him for the arrangement and the leading characters. The table I have added myself; it is necessarily artificial and, in several points, unsatisfactory, and I should prefer to do without it, but it may serve as a help to the identification of the species:—

I. Pubescence of underside, as a whole, weak, or partially or even entirely absent.
  i. Hind portion of the elytra more obliquely sinuate before apex, sometimes strongly produced; length 7½–12 mm. GROUP 1, p. 323.

  C. ganglbaueri, dormeri, waterhousei, willeyi.

  ii. Hind portion of elytra rounded or less obliquely sinuate.
    1. Intermediate tarsi dilated in the male; length 9–10 mm. GROUP 4, p. 336.

    C. tetrastacta.

    2. Intermediate tarsi not dilated in the male.
      A. Margins of elytra brilliantly and broadly metallic; length 8–12 mm. .... GROUP 2, p. 327.

      C. chloropleura, viridicincta, azureocincta, venus.

B. Margins of elytra not or only narrowly metallic.

a. Size very small, 6–7 mm.; one obscure little species, dark, with small white markings, separated from Group 7 only through the scanty pubescence of the underside .... Group 6, p. 360.

C. discreta.

b. Size small, 7½–9 mm.; elytra unicolorous, or with white markings at the margin only, or with the whole margin narrowly white and no other markings .... Group 30, p. 436.

C. limosa, andersoni, malabarica, gyllenhali.

c. Size moderate or rather large, 12–19 mm.*

*a**. Elytra, as a rule, oblong, with the sides parallel and the shoulders well marked†. Group 16, p. 387.

C. discrepans, hamiltoniana, andrewesi, mauritii, unica, lauræ, tritoma, assamensis, mouhoti, schmidt-goebeli, cariana, interrupto-fasciata, bicolor, mariæ, corbetti, hæmorrhoidalis, fabricii, octogramma.

*b**. Elytra less oblong and parallel-sided.

a†. Sides of pronotum without setæ.
Group 14, p. 384.

C. whithilli, sexpunctata.

b†. Sides of pronotum, and sometimes disc, with more or less pronounced setæ.

a‡. Elytra without crescent-shaped patch extending from the shoulders.

* Genæ with a few scattered hairs.
Group 12, p. 379.

C. intermedia, oberthuri.

** Genæ bare .... Group 15, p. 386.

C. aurovittata.

b‡. Elytra with a crescent-shaped patch extending from the shoulders for one-third or one-half of the elytra. Group 20, p. 411.

C. guttata, calligramma, dives, ceylonensis.

d. Size larger, 19–23 mm.; pubescence of underside very slight or absent.

a*. Elytra unicolorous, or with a single regular longitudinal yellow stripe, extending for nearly their whole length (var. *dejeani*) .. Group 17, p. 405.

C. cyanea.

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* *C. discrepans*, *C. assamensis*, and *C. ceylonensis* sometimes attain 20 mm.

† Exceptions occur, such as *C. assamensis* and *C. hæmorrhoidalis*, which might perhaps be included under the next heading.

*b**. Elytra black, with cruciform yellow markings, or with the yellow colour much extended, or with basal and apical markings and a transverse fascia between these............ Group 18, p. 406.

C. aurofasciata, princeps, angulicollis.

II. Pubescence of underside strong, at all events at the sides.

i. Epipleuræ without long pubescence at the sides of the metasternum.

1. Elytra oblong or oblong-ovate.

A. Upper surface not entirely smooth, glabrous and shining.

a. Size small, average length 8–9 or 10 mm. (very rarely attaining 11 or 12 mm.).

*a**. Genæ bare (except in *C. imperfecta,* in which species they bear a few scattered hairs).

a†. Elytra even; species obscure, dark, with or without more or less distinct light markings. Group 5 (*ex parte*), p. 337.

C. spinolæ, bigemina, viridilabris, nietneri, seriepunctata, leucoloma, fastidiosa, humillima, sinica, melancholica, undulata, imperfecta, distinguenda, germanica var. *kirilovi.*

*C. fuliginosa**. Group 23, p. 422.

b†. Elytra apparently or actually uneven, with or without velvety patches and foveæ. Group 5 (*ex parte*), p. 337.

C. dromicoides, motschulskyi, funebris, indica, triguttata, fallaciosa, belli, umbropolita, foveolata, holosericea, davisoni, prothymoides.

C. lacunosa, corticata. Group 3 (*ex parte*), p. 330.

*b**. Genæ pubescent; species dark, with more or less intricate whitish markings; length 8–10 mm. Group 7, p. 361.

C. erudita, grammophora, cognata, nitida, minuta, mutata.

*c**. Genæ setose at base only; length 8 mm.

C. atkinsoni. Group 22 (*ex parte*), p. 422.

b. Average length 12–16 mm. (rarely 10–11 mm.).

*a**. Elytra whitish or whitish testaceous, with antler-shaped markings.

a†. Underside entirely and thickly tomentose (except for a very small line in the centre); markings thin, proceeding from a dark longitudinal line on each side of the suture.

C. albina. Group 26, p. 427,

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* *C. fuliginosa* might reasonably be included under Group 5, but as Dr. Horn considers it to have close affinities to *C. striolata* I have left it in the position he has assigned to it.

b†. **Underside thickly pubescent at the sides, bare in the middle; markings broader, proceeding from the suture.**

a‡. Genæ bare .... GROUP 24, p. 423.
C. cancellata, histrio.

b‡. Genæ pubescent .... GROUP 25, p. 425.
*C. catena, striatifrons**.

*b**. Elytra dark, with an intricate light pattern (much as in Group 6), the chief feature being an irregular inverted V-shaped mark on each proceeding from the centre of the margins and nearly meeting at the suture. (In *C. cardoni* this mark is usually broken, leaving a single spot on the disc.) .... GROUP 8, p. 369.
C. angulata, sumatrensis, cardoni.

*c**. Elytra without any particular pattern of marking beyond spots or short longitudinal patches.

a†. Sides of prothorax with strong pubescence projecting beyond the margins of the pronotum and invading its disc.

a‡. Disc of pronotum with scanty setæ.

* Colour green or dark, with small markings at the margins .... GROUP 10, p. 376.
C. chloris, funerea.

** Colour very variable; ground-colour reddish, green, blue, dark, &c., with eight more or less regular spots on each. GROUP 9, p. 373.
C. aulica.

b‡. Disc of pronotum with marked setæ; length 10–11 mm............... GROUP 11, p. 378.
C. albopunctata.

b†. Sides of prothorax without or with comparatively feeble pubescence, not or scarcely projecting beyond the margins.

a‡. Elytra dark, with from seven to ten light spots or lines on each.

* Pubescence of margins of prothorax encroaching on the disc of the pronotum. GROUP 21, p. 415.
C. vigintiguttata, multiguttata, vittigera, lefroyi.

** Pubescence of margins of prothorax not encroaching on the disc of the pronotum .... GROUP 22 (*ex parte*), p. 418.
C. striolata.

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* **In *C. striatifrons* the testaceous ground-colour is much reduced, but the markings are on the same principle.**

b‡. Elytra variegated metallic, metallic, or velvety, in the latter case with or without large green punctures distributed on disc. GROUP 3, p. 330.

C. tetragrammica, westermanni, crassipalpis, rugosiceps, chlorida.

c. Length 17-25 mm.

*a**. Elytra velvety, more or less brilliantly coloured, with the whole underside brilliantly metallic. GROUP 13, p. 380.

C. octonotata, duponti, aurulenta.

*b**. Elytra velvety black, with the shoulders, apex and a transverse fascia in the middle orange-yellow .... GROUP 19, p. 411.

C. shivah.

B. Upper surface smooth, glabrous, and shining, dark metallic on disc, with the margins more or less broadly (regularly or irregularly) white; at the sides of the prothorax there is a thick fringe of setæ, projecting more or less beyond the sides of the pronotum; length 10-17 mm. .... GROUP 28, p. 430.

C. limbata, biramosa, maindroni, bellana, quadrilineata.

2. Elytra distinctly ovate or obovate, glabrous, white, with darker markings; pubescence of prosternum very thick and tomentose, and projecting in a fringe beyond sides of prosternum; genæ quite bare and shining; length 8-12 mm. .... GROUP 27, p. 428.

C. ornata, copulata.

ii. Epipleuræ of elytra furnished with long pubescence at the sides of the metasternum; legs, especially the posterior pair, much elongated; size very small (6-6½ mm.). GROUP 29, p. 435.

C. phalangioides.

GROUP 1.

This consists of four species, confined to Ceylon. They have all been comparatively recently described and are at present very scarce; when more examples have been found the descriptions may have to be somewhat modified. They are small or rather small insects with the elytra dull metallic and the front parts brighter, and are characterized by the obliquely sinuate hind parts of the elytra, and by having the episterna of the meta- and mesosternum furnished with more or less scanty pubescence, the episterna of the prosternum being bare and smooth.

They may be distinguished as follows:—

I. Labrum black, metallic; male with the apex of each elytron broadly and roundly truncate; pronotum in the female dilated behind; colour of elytra greenish ...... *ganglbaueri*, W. Horn, [p. 324.

II. Labrum dark brown; male with the apex of each elytron obliquely rounded; pronotum in both sexes parallel-sided; colour of elytra coppery brown .... *dormeri*, W. Horn, [p. 324.

III. Labrum yellow; pronotum in the female narrowed towards the front.

  1. Apex of each elytron broadly rounded off obliquely in both sexes, extreme apex subtruncate .... *waterhousei*, W. Horn, [p. 325.

  2. Apex of each elytron much prolonged and strongly sinuate in the female; male not known .... *willeyi*, W. Horn, p. 326.

98. **Cicindela ganglbaueri**, *W. Horn.*

Cicindela ganglbaueri, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 95; id., Spol. Zeyl. ii, 1904, pl. i, fig. 11.

A rather conspicuous species, with the front parts coppery, the inner side of the eyes, and the front and hind margins of the pronotum being violet, and the elytra mostly dark green; labrum metallic; head with plain longitudinal streaks; pronotum long, longer in the male than in the female, with the sides subparallel in the former sex and dilated behind in the latter, and the hind angles projecting; the upper surface is irregularly rugosely striate; elytra slightly rounded at the sides, contracted obliquely before apex, the apices not being elongate but jointly rounded and subtruncate in the female, separately rounded in the male, and with a very small sutural spine; on each there are three white spots, one, more remote from the margin than the other two, before the middle, one just in the middle, and the third near the subapical contraction of the elytra; just behind the first there is a shining spot or "mirror" in the female; the episterna of the metasternum and the sides of the abdomen are furnished with more or less scanty white pubescence.

Length 12 millim.

CEYLON.

99. **Cicindela dormeri**, *W. Horn.*

Cicindela dormeri, W. Horn, Deutsche Ent. Zeitschr. 1898, p. 198; id., Spol. Zeyl. ii, 1904, pl. i, fig. 10.

Allied to *C. ganglbaueri*, but much smaller and less elongate, with the eyes more prominent, the pronotum shorter, with the posterior angles not produced, narrower in the male than in the female, upper surface very finely and rather thickly transversely rugose; the elytra are shorter, more sinuate before apex, and not rounded conjointly in the female as in the preceding species, and the sutural apical angle ends in a distinct spine; the sides of the elytra are very gently sinuate; the colour of the front parts is coppery with the parts about the eyes cyaneous, and the base and apex of the pronotum green: the sides of the elytra, the apex rather broadly, and the suture narrowly, are golden green, not very shining, the whole disc being of an obscure velvety coppery brown; scutellum cyaneous; there are three rather conspicuous white spots on the elytra, the middle ones being slightly oblique; in the female there is a small bright spot close to the front one; the margins of the abdomen and the episterna of the metasternum are setose, but not so thickly as in *C. ganglbaueri*.

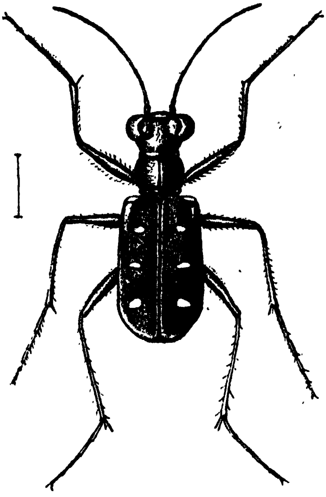

Fig. 144.—*Cicindela dormeri.*

Length 7¾–8¼ millim.

Cᴇʏʟᴏɴ: Kandy.

100. Cicindela waterhousei, *W. Horn.*

Cicindela waterhousei, W. Horn, Deutsche Ent. Zeitschr. 1900, p. 206; id., Spol. Zeyl. ii, 1904, pl. i, fig. 9.

A little larger than *C. dormeri*; of a coppery-bronze colour, with the front parts more or less variegated with golden green, blue, and red; labrum short, brownish testaceous, almost truncate; antennæ reddish, with the basal joints bright metallic; palpi mostly testaceous, mandibles whitish with dark apex; head distinctly striate between the eyes; pronotum parallel-sided in the male, a little rounded in the female, with the disc shining, very finely striate transversely; scutellum greenish blue; elytra dull, with narrow cyaneous margins and minute cyaneous specks, slightly sinuate at the sides, and contracted obliquely and slightly sinuately at some little distance from the apex, the interior sutural angle ending in a long sharp spine; on the side of each there are three spots, placed much as in the other allied species; the bright spot near the front one is present in the female; legs brilliant metallic green and blue, with the femora more or less golden; underside green and blue with the central parts golden; pubescence of sides of abdomen and of meta- and meso-sternum scanty but distinct.

Length 9–9½ millim.

CEYLON.

In the male there is a large white spot at the shoulders which appears to be obsolete and represented by a shining space in the female.

101. Cicindela willeyi, *W. Horn.*

Cicindela willeyi, W. Horn, Spol. Zeyl. ii, 1904, p. 7, pl. i, fig. 4.

Allied to *C. waterhousei*, but differs in having the forehead between the eyes more excavate and the vertex narrower, the pronotum narrower and longer, conical, gradually widened from apex to base, with the sides straight; the disc is more strongly transversely striated; the elytra are more dilated in the middle, the apical part is narrowed and arcuate for a much greater distance, and is more shortly rounded at the extreme apex, the sutural apical spine being much longer; the orbits, scutellum, extreme apex of the elytra, and the episterna of the prosternum are bright blue; the maxillary palpi are yellow with part of the apical joint dark; there are three white spots on each elytron, and a bright space near the front one in the female: the humeral spot is very small or wanting; the general colour of the elytra appears to be dull coppery, as in *C. waterhousei.*

Length 9½–10½ millim. (8–9½ *sine labro*).

CEYLON: Central Province.

Dr. Horn at the end of his description says:—"The other allied species are *C. dormeri*, m. and *C. ganglbaueri*, m. The former is already sufficiently distinguished by the parallel shape of the pronotum and the elytra. The latter is larger than the new species; all coppery reflections are replaced by greenish; the labrum is metallic black, the prothorax a little broader, and the elytra in the middle are much less dilated, the apex is broadly and simply rounded with a short sutural spine; the whole last joint of the maxillary palpi is metallic, &c."

To judge by the figure in the "Spolia Zeylanica" (*l. c.*) *C. willeyi* is an extraordinary-looking insect, very different from any of the other three species, the elytra being very strongly dilated, with wavy sides.

GROUP 2.

The members of this group are small but conspicuous insects, the elytra having broad and shining metallic margins; the underside is very slightly pubescent, the episterna of the metasternum being bare on the disc; length 8–12 mm.

Key to the Species.

I. Elytra with the metallic side margins neither dentate nor interrupted: length 10½–12 mm.
  1. Elytra with two conspicuous round whitish spots on each on the posterior half .... *chloropleura*, Chaud., p. 327.
  2. Elytra without spots............ *viridicincta*, W. Horn, p. 328.

II. Elytra elongate and parallel-sided, with the metallic side margins interrupted in the middle, and with a transverse yellow marking at the centre, followed by a spot at some distance before apex; length 12 mm. .... *venus*, W. Horn, p. 328.

III. Elytra short with the metallic side margins irregular and dentately produced before and about middle, with two small whitish spots on each on the posterior half; length 8–9 mm...................... *azureocincta*, Bates, p. 330.

102. Cicindela chloropleura, *Chaud.*

Cicindela chloropleura, Chaudoir, Cat. Coll. 1865, p. 59.

This species and its allies may be known by the broad and brilliant metallic colouring of the side margins of the head, pronotum and elytra, and of the suture of the latter; in *C. chloropleura* the labrum is long, rounded and raised in the middle, more or less metallic; head rather long, somewhat excavate and strongly striate between the eyes, which are moderately prominent; pronotum slightly transverse, with the sides rounded, subglobose, narrowed in front and behind, rather strongly rugose; head and pronotum coppery, shining, with the sides, two longitudinal markings (somewhat variable) on the former, and the depressions on the latter brilliant blue or green; elytra dull coppery red or olivaceous, dull, finely punctured, but distinctly at base, with brilliant blue or green margins and suture, and with two white spots on each, just touching the marginal colour, one at middle and one before apex; antennæ with the first four joints metallic; legs more or less metallic, trochanters red; underside brilliant green or violaceous with very little pubescence, episterna of metasternum bare on disc.

Length 10½–11½ millim.

Punjab: Simla; Sikkim: Darjiling; Assam: Sylhet.

103. Cicindela viridicincta, *W. Horn.*

Cicindela viridicincta, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 173.

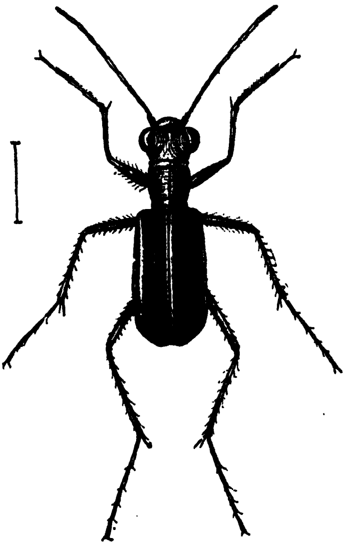

Fig. 145.—*Cicindela viridicincta.*

This species differs from *C. azureocincta*, with which Dr. Horn compares it, in its larger size, narrower head, less prominent eyes, longer and less constricted pronotum, more parallel-sided and flatter elytra, and in having the metallic side markings of the elytra green instead of blue, and quite even and not produced dentately on their inner edge. From *C. chloropleura*, which it more closely resembles in size and general appearance, it may be known by the less prominent eyes, longer pronotum, and the less strong sculpture of the front parts; the constrictions of the pronotum, moreover, are much less marked (so that the general shape is less globose), and are not metallic green or blue as in *C. chloropleura* (this may be variable); in some specimens, at all events, the metallic green band at the sides of the elytra ceases before the apex, whereas in *C. chloropleura* it is continued broadly to the apex; the pubescence of the underside is much as in *C. azureocincta*, the episterna of the metasternum being furnished scantily with hairs.

Length 9–12 millim.

Bengal: Chota Nagpur (*Cardon*); Bombay: Kanara (*Bell*); Madras: Nilgiri Hills (*H. L. Andrewes*).

104. Cicindela venus, *W. Horn.*

Cicindela venus, W. Horn, Deutsche Ent. Zeitschr. 1907, p. 22.

A beautiful and elegant species, with long parallel-sided elytra; labrum large, rounded at apex, dark metallic, nearly covering the

mandibles; palpi red or testaceous; antennæ cyaneous at base, fuscous towards apex; head large, with the eyes very large and prominent, the space between being plainly longitudinally striate throughout, the sculpture behind being fine, coppery with greenish and bluish reflections, and with the sides behind the eyes brilliant blue; pronotum slightly longer than broad, coppery, with the sides and front depression brilliant blue, very finely striate transversely, sides parallel, distinctly but not strongly constricted in front and behind; elytra long, parallel-sided, obliquely narrowed behind near apex, of a dull rich velvety reddish brown colour, with strong golden reflections in different lights, the suture, a large crescent-shaped patch on each at shoulders, and the margins from the posterior third to the apex being brilliant blue; inside the shoulders there is a strong depression, and the base is plainly punctured, especially at the sides; at the middle is a narrow transverse yellow band, reaching nearly across the elytron, but not touching margin or suture, broadest near margin and pointed near suture, and an irregular-shaped small patch between this and the apex; legs long, femora coppery, the tibiæ and tarsi dark, trochanters red or yellowish; underside cyaneous, bare, except for white tufts on the anterior and intermediate coxæ, and strong white pubescence along the fore edge of the posterior coxæ.

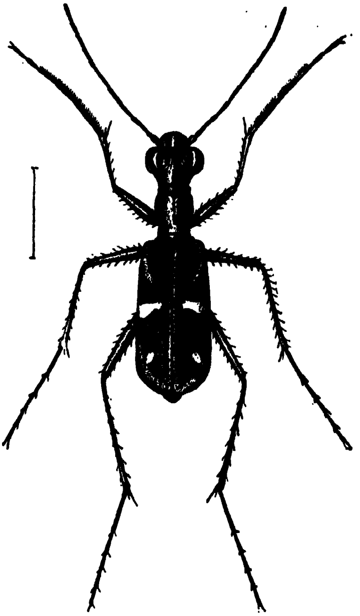

Fig. 146.—*Cicindela venus.*

Length 11–12 millim.

MADRAS: Nilgiri Hills (*H. L. Andrewes*).

The first specimen was taken in 1905, and several others have been found since; it appears, however, to be rare. This species lives in damp places, and has occurred on moist mossy rocks by a small river which runs through the estate of Mr. Andrewes and his brother; it has also been taken in the angles of a zigzag road where it is very moist; it appears also to be semi-arboreal in its habits.

Except for the characters of the labrum it is very closely allied to *Heptodonta* and might, apparently, be placed under that genus.

105. Cicindela azureocincta, *Bates.*

Cicindela azureocincta, Bates, Cist. Ent. ii, 1878, p. 333.

Allied to the preceding species but much smaller, with the general sculpture of the fore parts finer, but with the forehead distinctly striated; the pronotum is more globose, and the metallic margins of the elytra are irregular and produced internally in three places; the labrum, too, is shorter and more or less truncate; the colour is dull coppery with the sides, the suture of the elytra, and two longitudinal patches on the front of the head bright metallic blue, shining; the elytra are distinctly sculptured in front; underside violaceous, with the sides, including the episterna of the metasternum, scantily pubescent; the pubescence of the episterna is very scanty, but is quite apparent, unless rubbed off in old specimens; it does not appear to be sexual; legs red, tibiæ and tarsi darker, more or less pitchy.

Length 8–9 millim.

BOMBAY: Kanara (*Bell*).

This is one of the smallest and prettiest of all the CICINDELIDÆ.

GROUP 3.

The pubescence of the underside is much stronger in this group than in the preceding, but is more scanty as a rule on the episterna. In *C. crassipalpis*, however, a quite recently described species, the whole of the lateral parts of the pectoral region of the metasternum are densely covered with white bristles. It is possible that this species and *C.* (*Jansenia*) *westermanni* ought to be included in a separate section. The latter species is extremely rare, and only a few examples are known, but from the description it appears to be closely allied to this group, if it does not actually belong to it. The facies of the different members of the group varies considerably, *C. rugosiceps* being very like *C. chloropleura* and its allies, while *C. corticata* rather resembles *C. foveolata*.

Key to the Species.

I. Elytra even.
  i. Elytra with small green spots or punctures on each, besides two large whitish spots.
    1. Labrum dark, metallic; small green spots irregular .... *tetragrammica*, Chaud., [p. 331.
    2. Labrum testaceous, or æneous only at apex.
      A. Elytra more convex and much more narrowed towards base; small green spots irregular...... *westermanni*, Schaum, [p. 332.
      B. Elytra less convex and much less narrowed towards base; only one row of small green spots, near the suture .... *crassipalpis*, W. Horn, [p. 332.

ii. Elytra with two whitish or testaceous spots on each, but without small green spots or punctures.
  1. Labrum strongly metallic; disc of elytra dull, variegated; forehead with very strong wavy rugose sculpture; pubescence of the episterna of the pro- and meta-sternum scanty .... *rugosiceps*, Chaud., [p. 333.
  2. Labrum yellowish red; disc of elytra green; forehead with closer wavy rugose sculpture; pubescence of the episterna of the pro- and meta-sternum stronger .... *chlorida*, Chaud., [p. 334.

II. Elytra uneven.
  i. Elytra with three separate, not regular, small elevations occupying the middle of each .... *lacunosa*, Putz., p. 335
  ii. Elytra with two more or less regular longitudinal furrows on each........ *corticata*, Putz., p. 335.

106. Cicindela tetragrammica, *Chaud.*

Cicindela tetragrammica, Chaudoir, Cat. Coll. 1865, p. 58.

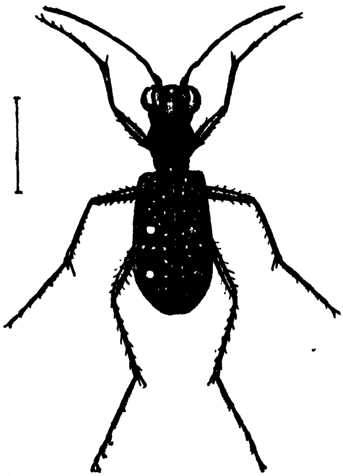

Fig. 147.—*Cicindela tetragrammica.*

A dark species, having the front parts black with more or less distinct coppery reflections, especially at the sides; scutellum metallic green; elytra somewhat widened behind, dull velvety black with two testaceous spots on the disc of each, one at middle and one behind, and with the surface irregularly sprinkled with small green or obscurely æneous ocelloid spots, a character that will at once distinguish the species; there is also a more or less obscure coppery patch at the shoulders, and the sides are also very narrowly and obscurely metallic at the extreme margins; labrum large, raised in the middle, metallic; in the sculpture of the head the species is allied to *C. rugosiceps*, the space between the moderately prominent eyes being very strongly striated at the sides and wavily rugose in the middle, the back part being finely sculptured; pronotum strongly and rugosely sculptured transversely, slightly narrowed to base, with the depressions and central line distinct; elytra punctured at the sides; legs dark, femora coppery; underside greenish and coppery in front, violaceous behind, with the sides of the abdomen, and all the episterna pubescent.

Length 12 millim.

MADRAS: Malabar Coast, Trichinopoli, Nilgiri Hills and Anaimalai Hills, 3000–4000 ft., May and June (*H. L. Andrewes*), Ramnad, Shembaganur (*teste W. Horn*).

107. **Cicindela westermanni**, *Schaum.*

Dromica westermanni, Schaum, Berlin Ent. Zeit. 1861, p. 75.
Jansenia westermanni, Chaudoir, Cat. Coll. 1865, p. 55.

Head large, coppery, with the forehead between the eyes closely striate; labrum large, circular in front with a small tooth in the centre, whitish testaceous, bronze at apex; mandibles testaceous at base, black in front, covered by the labrum; palpi entirely whitish testaceous; antennæ slender, filiform, metallic at base, black at apex; pronotum coppery, somewhat longer than broad, cylindrical, scarcely narrowed behind, with close irregular granulate rugose sculpture, not deeply constricted in front and behind, central line fine; elytra somewhat broader at base than the pronotum, oval, convex, blackish bronze, with the sides more coppery and shining, punctured, the punctures being closer at the sides, and with a sprinkling of larger green punctures on the disc; on each elytron there are two white spots; legs metallic, with the trochanters and tibiæ ferruginous red; underside cyaneous, with the sides of the sterna coppery, and the sides of the abdomen and the episterna clothed with white pubesence.

Length 10-11 millim.

MADRAS: Tranquebar, Madras, Coromandel.

This insect, which appears to be extremely scarce, is the type of Chaudoir's genus *Jansenia*. This genus has since been considered to contain a number of rather widely differing species, most of which are now rightly reunited to *Cicindela*, part being retained under *Euryoda*, which rests on very doubtful generic characters, and may with advantage be discarded.

108. **Cicindela crassipalpis**, *W. Horn.*

Cicindela crassipalpis, W. Horn, Records Ind. Mus. iii, Part iv, 1908, no. 41.

Allied to *C. westermanni*, Schaum, but with the forehead broader and more irregularly and less longitudinally striated in the middle, and the pronotum much broader, with the sides strongly rounded, and the greater breadth behind the anterior constriction; the elytra are less convex and much less narrow towards the base, rather velvety throughout, except for the æneous margins, with one series only of large green foveate punctures on the disc near the suture; the light markings also are somewhat different; the ground-colour of the elytra is blackish or brownish, but under a high power a number of minute punctures surrounded with æneous colour are visible, which in some lights show up more strongly than others; the close subreticulate sculpture is also very evident if magnified; the labrum is testaceous, long and roundly prolonged in the female, with one strong tooth in the middle, broad and transverse in the male, with the tooth smaller; the head and pronotum are coppery, sculptured much as in *C. catena*, much broader in the female than in the male; the whole head is without pubescence; the underside is mostly bluish cyaneous, with the whole of the lateral parts of the pectoral region of the metasternum and of the first four or five abdominal segments densely clothed with white setæ.

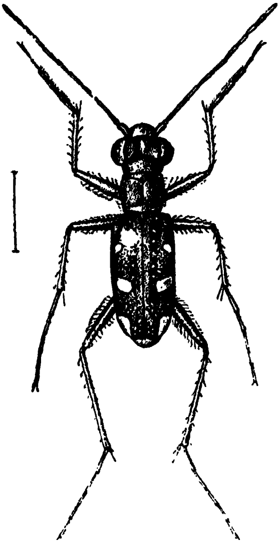
Fig. 148.—*Cicindela crassipalpis.*

Length 10–13½ millim. (9–12½ *sine labro*).

Madras: Podanur, near Coimbatore, 1000 ft., October, 1907 (*Captain A. K. Weld-Downing*).

This is a very compact and pretty little species, possessing a facies of its own, and quite distinct. I am much indebted to Mr. H. E. Andrewes for the loan of one of the very few specimens yet discovered.

109. **Cicindela rugosiceps**, *Chaud.*

Cicindela rugosiceps, Chaudoir, Cat. Coll. 1865, p. 57.

In general appearance much resembling *C. chloropleura*, Chaud., from which it may be at once known by the sculpture of the head and pronotum and the interrupted metallic colour of the sides of the elytra; labrum large, metallic; antennæ with the first joint coppery, the next three cyaneous, and the rest dull, pitchy; head and pronotum coppery, with the sides of the former, the sides and depressions of the latter, and the thin central line, bright blue or green; at the sides there are a few distinct outstanding white setæ; the sculpture of the head and pronotum is very strong; in the former the part just inside the eyes is striated, and the rest is rugose, more or less convolutely in front, transversely behind; in the latter the sculpture is much the same as on the back of the head, being more or less transverse; the pronotum is slightly transverse, with the sides rounded;

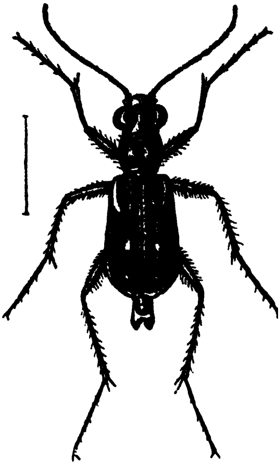

Fig. 149.—*Cicindela rugosiceps.*

the elytra are subparallel-sided, dull, sculptured throughout, but much more strongly, though not closely, in front, obscurely variegated, the ground-colour being greenish or yellowish, with the suture metallic and the space next it dark reddish; this colour also adjoins the other metallic green or blue markings at the sides and apex, which are as follows: a crescent-shaped patch at the shoulders, extended towards suture at its apex and a patch touching the margin behind the middle, sometimes broken off, and sometimes joining the metallic margin of the apex; on each elytron there are two larger or smaller white spots on the disc, one at about the middle and one before apex; femora coppery, tibiæ and tarsi dark; underside with rather strong white pubescence, which is scanty on the episterna of the meta- and pro-sternum, and absent on the genæ.

Length 11–11½ millim.

MADRAS: Mysore, Nilgiri Hills (*H. L. Andrewes*), Ramnad.

Mr. Andrewes writes: "May, 2500–3500 feet, Pillar and Coonoor Ghat. On paths and rocks; very active; making great onslaught on flying termites."

110. Cicindela chlorida, *Chaud.*

Cicindela chlorida, Chaudoir, Cat. Coll. 1865, p. 56.

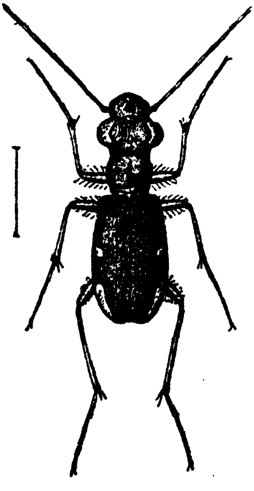

Fig. 150.—*Cicindela chlorida.*

Green, with the lateral margins of the pronotum and elytra reddish æneous, and the underside cyaneous, variegated with green, with the genæ and the sides of the sterna and of the base of the abdomen coppery; labrum yellowish red, antennæ pitchy with the first joint lighter; head moderate, closely rugose in wavy lines, striated near the eyes, which are moderately prominent, front between them scarcely excavate; pronotum shorter than broad, with the sides somewhat rounded, much more finely sculptured than the head, with the central line sometimes obsolete, and the central part transversely raised; elytra velvety, subparallel-sided, moderately long, gradually narrowed from behind middle towards apex, with the base and the sides in front punctured, and the middle and apex smooth, and with two rather large pale testaceous spots on each near the margin, a round one at the middle, and a posterior one which is larger and elongate; legs, including coxæ, rufo-testaceous, with the femora slightly æneous; underside with the episterna of the pro- and meta-sternum and the sides of the abdomen set with white villose pubescence.

Length 10½ millim.

MADRAS: Malabar Coast, Podanur, near Coimbatore (*Captain A. K. Weld-Downing*).

111. **Cicindela lacunosa**, *Putz.*

Cicindela lacunosa, Putzeys, C. R. Soc. Ent. Belgique, 1875, p. 68.

A very small species; head, pronotum and elytra entirely æneous, the latter very uneven, with two white spots on each, the first round, on the centre of the disc, a little behind the middle, the second larger, almost triangular, just before the apex near the margin, labrum testaceous, short and bisinuate; head rugose; pronotum subquadrate, slightly narrowed towards the base, with the sides slightly rounded and abruptly constricted in front and behind, and with the sculpture a little stronger than on the head; at the sides there are scanty white hairs, which are easily rubbed off; elytra elongate, subcylindrical, a little enlarged before the middle, obliquely truncate behind; there are three separate irregular and smooth elevations occupying the middle of each elytron, the rest of the surface being punctured; between the larger elevations and the suture there is another less distinct; underside mostly blue, bordered with golden green; sides of the body, including the episterna, with long and scanty pilose pubescence.

Length, ♂ 8, ♀ 9 millim.

CEYLON: Puttalam, October (*teste W. Horn*), Habarane (*E. E. Green*).

112. **Cicindela corticata**, *Putz.*

Euryoda corticata, Putzeys, C. R. Soc. Ent. Belgique, 1875, p. 69.
Var. *Cicindela læticolor*, W. Horn, Spol. Zeyl. ii, 1904, p. 7.

Entirely coppery bronze, with the sides cyaneous or green (this is more or less obscure in some specimens) and the underside cyaneous; labrum testaceous, with a dark spot in front; head and pronotum sculptured much as in *C. rugosiceps*, but not so strongly; pronotum as long as, or a little longer than, broad, subcylindrical, not strongly constricted in front or behind, with a few short white hairs (easily rubbed off) at the sides; elytra long, cylindrical, a little narrowed in front, with the surface uneven, each having two obscure and very irregular broad and shallow furrows; the surface is covered with strong punctures towards base which are finer behind, and are rarely confluent, and there is a series of larger æneous or greenish punctures (8 or 9) on each side of the suture; the suture is a little raised; on each elytron there are two white or yellowish spots, almost round, near the external margin, the first a little below the middle, the other near apex; underside with the sides (including the episterna but not the genæ) very scantily clothed with long white hairs; prosternum with large punctures; femora coppery, tibiæ and trochanters red, tarsi pitchy.

Length 9 millim.

CEYLON; MADRAS: Trivandrum, Travancore, Nilgiri Hills, 1250-3500 feet, May (*H. L. Andrewes*), Ramnad, Trichinopoli.

Var. **læticolor**, *W. Horn.*

Larger and more robust than the type, with the head and pronotum thicker, the episterna of the prosternum a little more thickly punctate-pilose, and the elytra more ample and even, with the row of larger metallic punctures more evident and the general punctuation more scanty; the anterior light spot is longer and nearer the margin; the femora are pale and only here and there metallic and the last joint of the maxillary palpi (which is partly dark in the type) is entirely yellow; the general colour of the upper surface is more brightly æneous, the elytra being dull. The male is smaller and narrower than the female and has the apex of the abdomen more tapering.

Length 9–10¼ millim.

CEYLON.

GROUP 4.

One species only belongs to this section, *C. tetrastacta*, Wied., which Dr. Horn at first placed under a new genus *Tetreurytarsa*, but has now referred to *Cicindela*; it is characterized by him as follows:—

"Male with the first three joints of the anterior and intermediate tarsi dilated (as in *Heptodonta*); labrum moderately produced, without teeth. Female with the labrum moderately produced, with three teeth. Male and female with the penultimate joint of the labial palpi thickened and inflated and the last joint small; sides of the abdomen sparingly pilose."

The episterna are scantily pubescent; the upper surface is shiny and brilliantly coloured, being mostly crimson or coppery crimson with bright blue and green metallic margins. It is a small species, with a long cylindrical pronotum, and at first sight bears a superficial resemblance to *Euryoda limbata*; except for the dilated intermediate tarsi of the male it is quite distinct from *Heptodonta*, and cannot be included under that genus.

113. **Cicindela tetrastacta,** *Wied.*

Euryoda tetrastacta, Wiedemann, Zool. Mag. ii, 1, 1823, p. 65; W. Horn, Deutsche Ent. Zeitschr. 1905, p. 33.
Tetreurytarsa tetrastacta, W. Horn, op. cit. 1892, p. 94.
Cicindela colon, Klug, Jahrb. Ins. i, 1834, p. 11.

In size and shape resembling *C. corticata*, but much more brilliantly coloured and more shining; labrum large, testaceous, with dark anterior margin; antennæ reddish at base, darker towards apex; head and pronotum metallic crimson, elytra red or more or less violaceous, the sides of all three being brilliant violet, green and copper; head with two brilliant longitudinal green and blue stripes in front, sculptured as in *C. rugosiceps*, striated next eyes, central part wavily rugose, hinder part more finely sculptured; pronotum subcylindrical, longer than broad, with the sides subparallel, somewhat narrowed before the basal constriction, distinctly sculptured, central furrow obsolete, marked by a more or less interrupted metallic line; elytra almost parallel-sided, slightly widened behind, with the suture metallic and slightly raised, strongly punctured in front, feebly on the posterior third; on each elytron there are two round white spots, one smaller, behind the middle, and the other much larger, close to the margin, at some little distance before apex; femora coppery, knees, tibiæ and trochanters testaceous red, tarsi pitchy at the apex of the joints, the anterior and intermediate pairs being dilated and pubescent beneath in the male; underside brilliant violaceous, with the sides of the abdomen and the episterna scantily clothed with white hairs; genæ bare.

Length 9–10 millim.

BENGAL: Calcutta, Birbhum, Chota Nagpur, Nowatoli, Asansol; BOMBAY: Dharwar (*H. E. Andrewes*).

GROUP 5.

A obscure group of small dark insects, with or without lighter spots or markings on the elytra; the sides of the abdomen and the episterna are more or less strongly pubescent, and the upper surface of the sides of the pronotum is, in many cases, furnished with distinct white setæ; the average length is 8 to 9 or 10 mm., but it varies from 7½ to 12 mm., although it only reaches 11 or 12 mm. in large specimens of one or two species; the genæ are bare, except for the type form of *C. imperfecta*, Chaud., in which they are scantily furnished with white hairs; in the var. *atelesta*, Chaud., these are absent.

The table given below is merely provisional. It is almost impossible to separate several of the species without comparing actual examples. The group is perhaps the most obscure in the genus.

Key to the Species.

I. Prothorax not markedly narrow and elongate, usually subquadrate, or slightly longer than broad.

- i. Elytra more or less uneven, velvety or with velvety patches, but not foveolate.
  - 1. Elytra much narrower at base than behind middle, apices much produced .... *dromicoides*, Chaud., p. 340.
  - 2. Elytra with the sides parallel or subparallel, apices not, or scarcely, produced.
    - A. Elytra with two transverse velvety patches on each, meeting or nearly meeting, at suture.
      - *a.* Labrum testaceous; elytra not strongly punctured or shining on their anterior fourth part.
        - *a**. Size smaller (9–10 mm.); pronotum broader in proportion and more narrowed behind........ *funebris*, Schm.-Goeb., p. 341.
        - *b**. Size larger (10–11½ mm.); pronotum narrower in proportion and less narrowed behind...... *motschulskyi*, W. Horn, p. 342.
      - *b.* Labrum dark, metallic; elytra dull with the anterior fourth part strongly punctured and shining.. *indica*, Fleut., p. 342.
    - B. Elytra each with a longer or shorter longitudinal smooth velvety patch parallel with the suture (usually distinct, but occasionally more or less obsolete in some specimens).
      - *a.* Eyes less prominent; elytra more thickly punctured at the sides.
        - *a**. Elytra with larger punctures towards the base .... *triguttata*, Herbst, p. 343.
        - *b**. Elytra without larger punctures towards the base .... *fallaciosa*, W. Horn, p. 343.
      - *b.* Eyes more prominent; elytra less thickly punctured towards the sides.
        - *a**. Posterior trochanters pitchy; episterna of prosternum strongly punctured .... *belli*, W. Horn, p. 344.
        - *b**. Trochanters clear red; episterna of prosternum impunctate or nearly impunctate .... *umbropolita*, W. Horn, p. 345.
- ii. Elytra more or less distinctly foveolate or subfoveolate.
  - 1. Elytra shining black, strongly foveolate; labrum testaceous.......... *foveolata*, Schaum, p. 345.
  - 2. Elytra dull black, scarcely foveolate; labrum dark .... *holosericea*, F. (= *viduata*, F.?), p. 345.

iii. Elytra even, without velvety patches or foveæ.

1. Outline of elytra regular or almost regular in both sexes.

A. Elytra with white spots or markings occasionally touching the margins, but with no part of the side or apical margins continuously white.

a. Pronotum with the disc strongly and brightly metallic and coppery; size small (7–8 mm.); episterna of metasternum rather thickly pubescent .... *spinolæ*, Gestro, p. 346.

b. Pronotum with the disc not brightly metallic, as a rule of much the same colour as the elytra.

*a**. Each elytron with a sinuate marking at the centre, just touching the margin and nearly reaching the suture .. *bigemina*, Klug, var. *procera*, W. Horn, p. 348.

*b**. Elytra with spots only.

a†. Each elytron with four white spots, not arranged in a row.

a‡. Eyes very prominent; head behind the eyes slightly arcuated and constricted ...... *viridilabris*, Chaud., p. 349.

b‡. Eyes moderately prominent; head behind the eyes at first dilated and then sharply constricted .... *nietneri*, W. Horn, p. 351.

b†. Each elytron with three white spots on each, arranged in a longitudinal row .... *seriepunctata*, W. Horn., p. 351.

B. Elytra with the margins from shoulders to apex continuously and distinctly whitish testaceous, and with a hooked marking proceeding from the centre of the margins .... *leucoloma*, Chaud., p. 352.

C. Elytra with the margins from shoulders to apex rather broadly and almost continuously whitish testaceous, but slightly interrupted at about the anterior and posterior fourth; markings of the elytra much as in *C. leucoloma* .... *fastidiosa*, Dej., p. 352.

D. Elytra with only the apical margins whitish testaceous.

a. Elytra not obliquely and rectangularly truncate at apex, and without greenish shallow punctures.

*a**. Each elytron with five white spots: one humeral, three on disc, and one joining a process of the white apical margin .... *decempunctata*, Dej., p. 353.

*b**. Each elytron with a sinuate marking at the centre, and a spot before and behind this, between the apical and basal marginal patches .... *bigemina*, Klug, p. 347.

b. Elytra obliquely and rectangularly truncate at apex, disc with shallow greenish punctures .. *germanica*, L., var. *kirilovi*, Fisch., [p. 354.

E. Elytra with more or less of the side margins, and the apical margins, narrowly whitish testaceous, but always with distinct interruptions; on each there is an inverted V-shaped, hooked or sinuate marking, proceding from the centre of the light marginal border.

*a**. Pronotum longer, slightly rounded at the sides and narrowed before base .... *sinica*, Fleut., p. 355.

*b**. Pronotum subquadrate, not, or scarcely, narrowed behind.

a†. Elytra of female with a more or less distinct smooth and shining patch on each in front, not far from the suture.

a‡. Pubescence of the underside coarser at the sides, almost tomentose .... *melancholica*, F., p. 356.

b‡. Pubescence of the underside less coarse at the sides, not tomentose .... *undulata*, Dej., p. 356.

b†. Elytra of female without a shining patch.

a‡. Pronotum with the sides not rounded .... *imperfecta*, Chaud., p. 357.

b‡. Pronotum with the sides slightly rounded .... *distinguenda*, Dej., p. 358.

2. Outline of elytra in the female very irregular .... *humillima*, Gestro, p. 355.

II. Pronotum narrow, elongate and cylindrical.

i. Elytra with two white spots on each, shorter and less parallel-sided and less thickly sculptured .... *davisoni*, Gestro, p. 359.

ii. Elytra without white spots, longer and more parallel-sided and more thickly sculptured .... *prothymoides*, W. Horn, [p. 359.

114. Cicindela dromicoides, *Chaud.*

Cicindela dromicoides, Chaudoir, Bull. Soc. Moscou, i, 1852, p. 21.

A peculiar-looking, dull, velvety, species, as a rule of an obscure dark brownish colour, the front part and the sutural region being dull bronze: occasionally, however, these parts are bright metallic green, with more or less obscure bronze lines; labrum testaceous, comparatively short; head large, with the eyes not very prominent, forehead scarcely excavate, plainly striated, vertex behind the eyes scarcely constricted, the hind portion or occiput being very closely and finely sculptured; antennæ dark, with the base metallic; pronotum rather long, slightly narrowed behind, about as long as the head without clypeus and labrum, sides very gently rounded in front, sculpture very fine, mostly transverse; elytra widened and rounded behind, widest behind middle, narrowed to base, broadly sinuate before the extreme apices which are rounded, velvety, with blurred lighter impressions, which look like abrasions of the surface, and with a rather large triangular spot just at the margin behind middle, and another, smaller and often more or less obsolete, before the sinuate portion of the apex; legs dark, more or less metallic with the tibiæ and tarsi more or less reddish; underside cyaneous; abdomen with a few white setæ, metasternum very finely sculptured, with very scanty and fugitive pubescence.

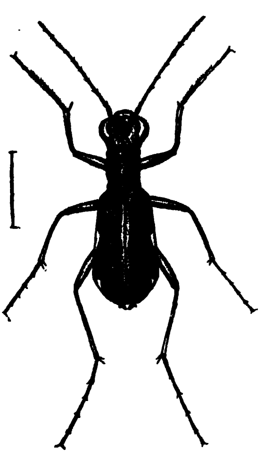

Fig. 151.—*Cicindela dromicoides.*

Length 11–12 millim.

Punjab: Simla; United Provinces: Kumaon (*Annandale*); Nepal; Sikkim: Kurseong, Darjiling, Mungphu; Bengal: Chota Nagpur (*Cardon*), Nowatoli (*Fleutiaux*); Assam; Khasi Hills.

In the Oxford Museum there is a specimen with the following label:—"Has wings, but always runs; thorax rather long; seems to depart from the ordinary types of *Cicindela*." This is certainly the case, and I cannot help thinking that it ought to be separated; it has been placed under *Parmecus*, Mots., and *Jansenia*, Chaud., but has again been restored to *Cicindela* by Dr. W. Horn. The pubescence of the underside is very easily rubbed off, and it was only after carefully examining several specimens that I came to the conclusion that it belonged to this group, to which Dr. Horn has rightly assigned it, if it is to remain under *Cicindela*.

115. Cicindela funebris, *Schm.-Goeb.*

Cicindela funebris, Schmidt-Goebel, Col. Faun. Birm. 1846, p. 8.
Cicindela dolens, Fleutiaux, Bull. Soc. Ent. France, 1886, p. 111.

A small species; head and pronotum metallic, æneous or green, elytra dark, dull, sometimes with greenish markings; labrum short, testaceous; head broad, with the eyes moderately prominent, the space between these finely striated; pronotum narrow, rather longer than broad, somewhat coppery at the sides, convex, slightly narrowed behind, with the sides rounded, distinctly rugosely sculptured, middle line obsolete; elytra with the sides almost straight in the male, widened behind in the female, uneven, with two velvety raised spaces on each (more apparent in some specimens than in others), depressed before apex, almost impunctate; at the margins there are two very small yellow spots, sometimes scarcely apparent, one just behind middle and one just at the ante-apical contraction; femora dark metallic, tibiæ and tarsi pitchy, or in part metallic; underside cyaneous, or in part dark coppery, with the sterna and abdomen bare, and with a strong fringe of white hairs on the edge of the posterior coxæ.

Length 9–10 millim.

PUNJAB; SIKKIM: Kurseong, Mungphu; ASSAM: Naga Hills, 4000 ft., N. Manipur; BURMA: Karen Hills.

116. Cicindela motschulskyi, *W. Horn.*

Cicindela motschulskyi, W. Horn, Deutsche Ent. Zeitschr. 1893, p. 198.

Very like *C. funebris* in general appearance, but larger, with the pronotum narrower in proportion and less narrowed behind; the apex of the elytra is more truncate; the colour is obscure coppery with the sides brighter; the elytra have two velvety patches as in *C. funebris*, and have each a minute white spot before apex; the head is more strongly striated and the general sculpture of the upper surface is stronger; the prosternum is more deeply punctured, and there is more pubescence on the underside.

Length 10–11½ millim.

BOMBAY: Kanara (*Bell*, in June).

117. Cicindela indica, *Fleut.*

Cicindela indica, Fleutiaux, Ann. Soc. Ent. France, 1893, p. 484.

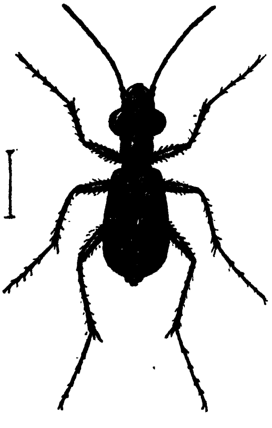

Fig. 152.—*Cicindela indica.*

A small black species with very slight æneous reflections; labrum dark, large; antennæ more or less pitchy at base; head short, broad, with very prominent eyes, strongly and rugosely sculptured and not striate; pronotum longer than broad, subcylindrical, with the sides slightly rounded, not strongly constricted in front and behind, roughly and strongly sculptured like the head; elytra uneven, strongly punctured and shining for their fourth part before base, dull behind; legs dark, part of tibiæ reddish; metasternum (and episterna) with scanty grey pubescence; abdomen with a few hairs.

Length 7–8 millim.

BOMBAY.

The dark labrum, short head, more prominent eyes and the sculpture of the head, pronotum, and elytra will at once separate this species from *C. funebris.*

118. **Cicindela triguttata**, *Hbst.*

Cicindela triguttata, Herbst, Käfer, x, 1800, p. 182, pl. 172, fig. 5; Dejean, Spec. Col. i, p. 146.
Cicindela chlorochila, Chaudoir, Bull. Soc. Moscou, 1852, i, p. 25: Gestro, Ann. Mus. Genova, 1889, p. 85.

Of the same general appearance as the preceding; labrum dark, more or less metallic; head and pronotum dark, with greenish or æneous reflections; elytra black, sometimes slightly metallic, each with a velvety patch parallel with the suture, and small variable whitish markings; these sometimes consist of a transverse short line at middle and another before apex, both reaching or almost reaching the margin, and a small spot on the disc not far from the suture just behind the middle; the side markings are sometimes extended, the middle one sometimes joining the central spot, and the hind one being extended towards apex; occasionally too there is a small spot on the disc before the middle as well as behind it: other variations also occur; head rather strongly striated; pronotum cylindrical, parallel-sided, scarcely constricted at all in front or behind, very finely sculptured, with the central line more or less obsolete; elytra with traces of longitudinal impressions, but practically even, with the sculpture variable, but, as a rule, well marked in front, at the sides and at apex; sutural angles produced; legs more or less metallic, tibiæ sometimes pitchy or ferruginous, tarsi sometimes bright blue; underside cyaneous or greenish, with the sides of the abdomen and the sterna rather thickly clothed with long white pubescence.

Length 7½–8 millim.

BENGAL: Calcutta; BURMA: Teinzo, Karen Hills (*Fea*), Pegu district; CHINA; PHILIPPINE ISLANDS; MALAY ARCHIPELAGO; BORNEO.

Var. **chlorochila**, *Chaud.*

A more or less brightly coloured greenish variety of the type; two specimens before me from Hong Kong, determined by Dr. Horn, seem distinct, being larger, entirely bright green above, with the elytra more evenly and strongly sculptured, but the Indian specimens, also named by him, appear to be scarcely varieties. I have, however, seen only very few.

Length 7–8½ millim.

BURMA: Teinzo, Bhamo, Tharawaddy, Taung-ngu, Pegu; TENASSERIM; CELEBES; HONG KONG.

119. **Cicindela fallaciosa**, *W. Horn.*

Cicindela fallaciosa, W. Horn, Deutsche Ent. Zeitschr. 1897, p. 57.
Cicindela viridilabris, Gestro (*nec* Chaud.), Ann. Mus. Genova, 1893, p. 355.
Cicindela chlorochila, Fleutiaux (*ex parte*), Ann. Soc. Ent. France, 1893, p. 485.

Closely allied to *C. triguttata*, of which it may prove to be only a variety; it differs (according to Dr. Horn) in having the apices of the elytra more separately rounded and subtruncate, the sutural spine shorter, the sculpture of the elytra before and behind almost the same (without larger punctures towards the base), and the white apical spot more rounded, and not produced behind into a marginal line; the transverse depressions of the pronotum (before and behind) and the central line are more distinct. The species is also allied to var. *labiocænea* of *C. viridilabris*, Chaud. (*nec* Gestro), but differs in having the forehead narrower and the eyes much less prominent; the elytra are less broad, with the anterior spot less approximate to the base, and the central posterior spot set further forward, all the spots being a little smaller.

Length 7–7½ millim.

BURMA: Teinzo, Karen Hills.

120. **Cicindela belli,** *W. Horn.*

Cicindela belli, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 174.

A small, dark, obscure-looking species which, according to Dr. Horn, is distinguished from its allies by the shorter, broader, and more convex elytra; the differences, however, are not very apparent, especially in the male; labrum green or coppery; head strongly striated between the eyes, only a small space in the centre being finely rugose; pronotum almost cylindrical, but somewhat variable, with the sides slightly rounded, scarcely constricted in front and behind, and with the sulci and central line feeble, sculpture finely rugose; in the specimens I have seen there are no hairs at the sides of the pronotum; colour of the head and pronotum obscurely metallic; elytra dull, obscurely metallic, with the sides shining, the shining colour being sometimes produced towards the disc; on each elytron there is a more or less distinct velvety longitudinal darker patch near the suture giving the surface an uneven appearance, and three yellowish spots, one marginal and just before the middle, a second discoidal and behind the middle, and a third longitudinal and arising obliquely from the margin, just before the apex; these, however, are very variable and obscure, and are often partly or even entirely wanting; there is a strong but short impression just inside the shoulders; the punctuation is distinct at sides and towards base, but irregular; underside greenish or cyaneous, with scanty pubescence throughout, the centre of the abdomen being bare; posterior trochanters pitchy; episterna of sternum strongly punctured.

Length 7–8 millim.

MADRAS: Travancore (*Maindron*), Mahé; BOMBAY: North Kanara (*Bell*), Belgaum (*H. E. Andrewes*).

This species is closely allied to *C. triguttata* var. *chlorochila*, but may be known by its shorter head, more prominent eyes, shorter and narrower elytra, and the different sculpture of the latter.

121. Cicindela umbropolita, *W. Horn.*

Cicindela belli, W. Horn, subsp. *umbropolita*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 61.

Dr. Horn regards this species as a variety of *C. belli*, but it appears to be distinct; it is closely allied to the latter, but differs in its larger size, somewhat more prominent eyes, longer and less convex elytra, clear red trochanters, and in the more sparingly pubescent underside and impunctate, or almost impunctate, episterna of the prosternum; this last character is very evident in the specimens before me; the general colour is dull coppery brown, the front parts and the sides of the elytra being more plainly metallic; the shining margins of the latter are produced into a triangularly dentate patch at the middle; the velvety longitudinal darker patch is more marked, and the intra-humeral impression is longer and more pronounced; the white spots are more distinct and are differently situated, one being placed behind the middle near the suture, and another between this and the apex on the centre of the disc; occasionally there appears to be a spot or shining dark space before the middle.

Length 8 millim.

MADRAS: Nilgiri Hills (*H. L. Andrewes*).

Apparently fairly common. Mr. Andrewes takes it on paths in the Ouchterlony Valley, at an altitude of from 2500 to 5000 feet.

122. Cicindela foveolata, *Schaum.*

Cicindela foveolata, Schaum, Journ. Ent. viii, 1863, p. 60.

Black, rather shining, very uneven; labrum large, testaceous, with the anterior margin dark; palpi yellow with dark apex; head slightly depressed between the eyes, plainly striated, finely sculptured behind; pronotum with slight bronze reflection, especially at the sides, subcylindrical, parallel-sided, scarcely constricted, finely sculptured, with a foveolate central line, deeper before base, and sometimes with more or less distinct traces of foveæ on each side; elytra shining, subparallel-sided, very uneven, foveolate, distinctly but not closely punctured, especially on the anterior half and before apex; legs dark, femora more or less coppery, trochanters red; underside cyaneous or greenish, episterna punctured and distinctly, though scantily, pubescent, metasternum strongly pubescent, centre of abdomen bare.

Length 8 millim.

BOMBAY: Kanara (*Bell*); BENGAL: Dacca; BURMA: Karen Hills, Teinzo (*Fea*), Tharawaddy (*Corbett*); SUMATRA; CELEBES (*Wallace*).

123. Cicindela holosericea, *F.*

Cicindela holosericea, Fabricius, Syst. El. i, 1801, p. 243.
? *Cicindela viduata*, Fabricius, Syst. El. i, 1801, p. 242.
? *Cicindela myrrha*, Thomson, Arch. Ent. i, 1859, p. 129.

Very closely allied to *C. foveolata*, from which it may at once be known by its black labrum, which appears usually to have a metallic reflection, somewhat more excavate head, more finely sculptured pronotum, and duller and more velvety elytra, which are uneven, but less foveolate; from *C. funebris* it may at once be known by the sculpture of the elytra, which are narrower and more parallel-sided, the dark labrum, narrower head and more prominent eyes; the pronotum also is more cylindrical; compared with *C. triguttata* it has the elytra much more uneven, and the white markings of the latter species are absent or reduced to mere points; it must, however, be allowed that it is somewhat closely allied to the latter species, and that transitional examples sometimes occur.

Length 7–7½ millim.

BENGAL: Chota Nagpur, Asansol, Nowatoli; ASSAM: Khasi Hills; BURMA: Karen Hills; JAVA.

I have adopted Dr. Horn's synonymy, although, if correct, the name *viduata* ought to come before *holosericea*. The descriptions of Fabricius are very vague.

124. Cicindela spinolæ, *Gestro*.

Cicindela spinolæ, Gestro, Ann. Mus. Civ. Genova, 1889, p. 85.

Head and pronotum sometimes rather obscurely, but, as a rule, rather brilliantly metallic, more so than in the allied species, a character which often serves superficially to distinguish it; labrum short, dull testaceous or partly metallic, occasionally entirely metallic, mandibles white with dark tips; head rather strongly striate between the eyes, with two longitudinal blue and green stripes, the hinder part of the pronotum finely rugose; pronotum subquadrate, with the sides very slightly rounded, and the constrictions well marked; at the sides there are a few white hairs, which are, apparently, easily rubbed off and are therefore often entirely absent; elytra dull coppery, or with a greenish reflection, brighter at the sides, with a strong impression within the shoulders, and with a white spot at the shoulders, another on the disc before the middle, another at the middle of the

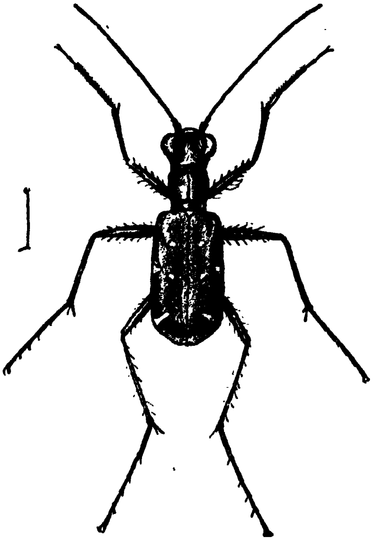

Fig. 153.—*Cicindela spinolæ*.

lateral margin, either joining a discoidal spot near the suture and forming an oblique band narrowed in the middle, or else separate from it, and another variable spot (round, oblique or partly crescent-shaped) before the apex; the punctuation is shallow but usually distinct, except on the centre of the disc, and the punctures are often greenish; the elytra are rather strongly depressed before the apex and are slightly dilated behind the middle, the sutural angle being furnished with a very short spine; legs more or less metallic, trochanters ferruginous; episterna of metasternum rather thickly pubescent; the sides of the prosternum and abdomen are scantily pubescent, the former being almost bare and not punctured.

Length 7–8 millim.

SIKKIM: Darjiling; BENGAL: Dacca, Chota Nagpur, Asansol; ASSAM: Sylhet, Patkai Hills; BURMA: North Chin Hills, Teinzo, Bhamo, Tharawaddy, Karen Hills, Ruby Mines, Momeit, Rangoon; TENASSERIM; COCHIN CHINA.

Taken in deep jungle (*Annandale*).

125. **Cicindela bigemina**, *Klug*.

Cicindela bigemina, Klug, Jahrb. Ins. i, 1834, p. 30.
Cicindela tremula, Brullé, Arch. Mus. Paris, i, 1835, p. 135, pl. 9, fig. 3.
Cicindela iravaddica, Gestro, Ann. Mus. Genova, 1893, p. 35.
Cicindela bigemina subsp. *procera*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 34.
Cicindela bigemina subsp. *brevis*, W. Horn, l. c.

In general appearance much resembling several of the allied species; of an obscure brownish or greenish colour with metallic reflections, which are stronger on the front parts; labrum clear whitish testaceous, head depressed and distinctly striate between the eyes, occiput and pronotum very finely rugose; the latter longer than broad, parallel-sided, with the impressions and central line feeble; elytra with the suture coppery and the extreme margins greenish metallic, dull, uniformly and thickly, but feebly, punctured, as a rule, but variable, the punctation of the apex and base being sometimes stronger and the disc almost smooth; on each elytron there is a whitish yellow spot at the shoulder, two on the disc, one before and one behind the middle, an inverted and curled **V**-shaped mark at the middle reaching the margin, and a line (not widened into a spot at either end and sometimes much reduced) along the oblique margin before the apex; legs metallic, trochanters pitchy; underside violaceous or greenish, coppery in front, with much thicker pubescence than in the allied species, the genæ and extreme middle of the abdomen alone being bare. In the male there is a large seta on the first joint of the antennæ and a small bunch of hairs on the fourth joint.

Length 9–10 millim.

SIKKIM: Pankabari, Kurseong; BENGAL: Purneah, Calcutta, Maldah, Murshidabad, Berhampur, Sara Ghat, Chota Nagpur; CENTRAL INDIA: Gwalior; BOMBAY: N. Kanara.

According to Mr. Annandale this species does not occur at great altitudes, and has been taken at light on board the Ganges ferry steamers.

Var. **iravaddica**, *Gestro.*

This variety differs from the type in being slightly broader, with the pronotum narrower, but these differences are scarcely apparent; the central fascia of the elytra is straighter and less elbowed and the apical white border does not touch the suture; the last character, however, varies in the type-form; the strong seta on the first joint of the antennæ, and the small bunch of hairs on the fourth are wanting in the male.

Length 9–10 millim.

BURMA: Mandalay, Katha, Teinzo (*Fea*), Tharawaddy (*Corbett*).

Var. **procera**, *W. Horn.*

Differs from the typical form in being considerably smaller, and in having the labrum and head narrower, the pronotum more strongly constricted and more strongly sulcate, with the intermediate part more convex and the sides more scantily setose; the elytra are narrower with finer sculpture, and the apical margin, instead of a white line, has an elongate triangular patch at the external apical angle; underside, including the legs and posterior trochanters, coppery bronze, with golden reflections here and there; the colour of the upper surface is coppery brown.

Length 8 millim.

"IND. OR. (*Boucard*)."

There is a female specimen in Mr. Nevinson's collection which should perhaps be referred to this variety.

Var. **brevis**, *W. Horn.*

Differs from the typical form in the shape of the labrum, which is truncate and armed with a short central tooth, in its smaller and more coarsely striate head, the much shorter elytra, and the broader white markings; the anterior discoidal spot is near the base, the central fascia is thickened at the margin, and the marginal line at the apex is thickened at the side (where it sometimes joins the spot before apex), and towards the suture; the underside and the legs are more coppery, and the trochanters are brownish purple.

Length 8½ millim.

"IND. OR." (*teste W. Horn*).

126. Cicindela viridilabris, *Chaud.*

Cicindela viridilabris, Chaudoir, Bull. Soc. Moscou, 1852, p. 24.
Cicindela labioænea, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 79.
Cicindela severini, W. Horn, Ann. Soc. Ent. Belgique, 1892, p. 537.
Cicindela viridilabris, var. *fusco-cuprascens*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 60.

A small species; labrum metallic green, mandibles dark with the upper side of the base white; antennæ black with the first four joints coppery; head and pronotum shining bronze-green, the colour being brighter at the sides, the former striated near the eyes, very strongly rugose in the middle and in front, the latter about as long as broad, slightly constricted in front, with the sides rounded and slightly sinuate before the base which is feebly bisinuate, strongly and rugosely sculptured, for the most part transversely, impressions in front and behind well-marked, central line obsolete; elytra parallel-sided, not widened behind, with the shoulders quite square, slightly sinuate near the apex of the suture, which is terminated by a small tooth; upperside slightly convex, even, with feeble and not close uniform punctuation; the colour is obscure æneous with a shining lateral bronze-green band, commencing at the shoulder and terminating at half the length; on each there are four spots, one very small, in the middle, at the first quarter, the second lateral, slightly transverse and triangular, in the middle of the margin, the third lower, round, not far from the suture, and the fourth oval, near the margin, representing the upper end of an unfinished crescent; punctuation green; legs shining coppery with green tarsi; underside cyaneous, with the sides of the front parts more or less coppery; the whole of the sides are scantily furnished with white pubescence.

Length 6½–7 millim.

"EAST INDIES."

Two specimens only of the type-form appear to be known but their locality is doubtful, being merely given as "Indes orientales." Dr. Horn thinks that they are probably from North India. I have not seen them, and the above description is abbreviated from the detailed description of Chaudoir. The very scanty material of the type-form renders it difficult to determine the right value of the varieties.

Var. **labioænea,** *W. Horn.*

This variety agrees with Chaudoir's description of the type, except that it is somewhat larger, with the rugose sculpture of the head and pronotum very fine, the central line of the latter distinct, and the bright band which reaches half way down the side of the elytra represented by a crescent-shaped spot of bright metallic coppery green at the shoulders, occupying about a quarter of the length; the ante-apical spots are also rounded as a rule, but the markings are somewhat variable.

Length 8 millim.

CEYLON: Kandy.

Dr. W. Horn in his description (*l. c.*) compares the species with *C. 10-punctata*, and does not mention *C. viridilabris* in connection with it, and says that it differs from the first-named species in having the head and pronotum much more rugose. This is certainly the case; *C. 10-punctata*, moreover, is a larger insect with wider elytra, and has a longer and more parallel-sided pronotum with more distinct pubescence at the sides; the markings are somewhat similar but there is a white spot at the shoulders, which is absent in the var. *labioænea*.

Var. **severini**, *W. Horn.*

This variety is distinguished, according to Dr. Horn, from the var. *labioænea* by the less projecting eyes, the finer sculpture of the orbital plates and of the pronotum, the more distinctly defined metallic space at the shoulders of the elytra, the more sparingly punctured and pubescent episterna of the prosternum, and the more scantily pubescent sides of the pronotum; the elytral spots are on the whole more distinct in the specimens I have seen, but there is very little difference between the two varieties; and it would be a difficult matter to separate them if a considerable number were mixed together.

Length 8 millim.

MADRAS: Travancore; Nilgiri Hills, 2500–5000 ft. (*H. L. Andrewes*, May to July); BOMBAY: Kanara; BENGAL; BURMA: Teinzo; TONKIN.

Var. **fusco-cuprascens**, *W. Horn.*

Larger and more robust than the type-form, with the head and pronotum broader, and the shining humeral space more crescent-shaped; the anterior discoidal spot is larger, and the ante-apical spot is not produced behind; the whole breast, front and pronotum are coppery, and the elytra are of a dull velvety fuscous coppery colour, with the exception of the humeral crescent; the elytra are more sparingly but more distinctly punctured than in the var. *labioænea*, from which it may also be known by its colour, and the brownish metallic penultimate joint of the maxillary palpi.

From the var. *severini* it may be distinguished by the more strongly projecting eyes, the somewhat coarser sculpture of the forehead and pronotum, the bright brown upperside, coppery breast, distinct elytral punctuation, less shining humeral patch, and the stronger punctuation of the episterna of the prosternum.

Length 8½ millim.

MADRAS: Nilgiri Hills, 1250 ft. (*H. L. Andrewes*, May), Trichinopoli.

127. Cicindela nietneri, *W. Horn.*

Cicindela nietneri, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 220.

Allied to *C. viridilabris*, Chaud., from which it differs in having the pronotum more constricted in front, the sides slightly more rounded, and the anterior reflexed margin transversely striolate; the elytra are longer, more impressed before the apex, with the separate apices more rounded; the colour of the upperside is dull, almost black, with the sides of the head and pronotum obscurely dark green, and the shoulders of the elytra with a metallic green and purple or violaceous spot of the same type as in var. *labioœnea*; the four yellow spots are larger and somewhat differently situated, the four central ones being more nearly in line, but in this section this character is always more or less variable.

Length 8 millim.

CEYLON.

I have seen only one specimen of this species, named by Dr. Horn; it is not in good condition, but appears to me to be not distinct superficially from *C. viridilabris*; the striation of the reflexed anterior margin of the pronotum is certainly present in the var. *labioœnea*, and in other allied species, and there is no appreciable difference in its shape and sculpture.

128. Cicindela seriepunctata, *W. Horn.*

129. Cicindela leucoloma, *Chaud.*

Cicindela leucoloma, Chaudoir, Bull. Soc. Moscou, 1852, p. 12.

Closely allied to *C. fastidiosa,* from which it differs in having the pronotum narrower and straighter at the sides, and the margins irregularly, but entirely and without interruption, whitish testaceous; head and pronotum rather bright green, the former finely striated between the eyes and very finely rugose behind, the latter finely but distinctly rugose, with short hairs at the sides; elytra greenish, with the sculpture feeble and variable, in some specimens more plain than in others; from the light margin there proceeds a transverse line or linear patch at some little distance from the shoulders, usually widened into a round spot on the disc; in the middle there is a hooked patch and between this and a produced line from the upper part of the apical margin there is a spot; femora coppery, tibiæ and tarsi reddish, trochanters clear red; underside green and coppery in front, blue behind, distinctly pubescent, except the middle of the abdomen and the genæ, which are smooth and bare, except for a few scattered hairs on the former.

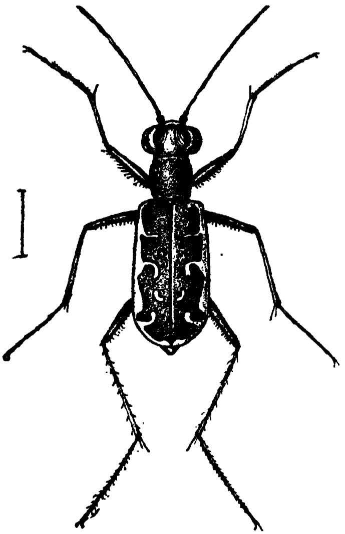

Fig. 154.—*Cicindela leucoloma.*

Length 7½-9½ millim.

PUNJAB: Simla (*teste Chaudoir*).

The specimens I have seen are all labelled "India" or "East India." There is a small bright coloured specimen in Mr. Nevinson's collection, with thicker pubescence on the underside and slightly different elytral markings; but it evidently must be referred to this species.

130. Cicindela fastidiosa, *Dej.*

Cicindela fastidiosa, Dejean, Spec. Col. i, 1825, p. 95.
Cicindela litigiosa, Dejean, l. c. p. 97.
Cicindela despecta, Fleutiaux, C. R. Soc. Ent. Belgique, 1886, p. 88 (*ex parte*).

Closely allied to the preceding, but smaller, with the elytra in the female widened behind and not in the middle, and with the striation of the forehead stronger and the pronotum more rugose, the hairs at the sides being much less evident and shorter; the trochanters are red and the genæ not pubescent; the markings of the elytra are different, the margins being much more broadly and unevenly whitish testaceous; at the shoulders there is a crescent, produced behind into a sharp point, which almost joins a spot on the disc; the narrow band starting from the centre of the margin is strongly hooked and ceases at about the middle of the disc; below the apex of this and nearer the suture is a white spot, and the apical margin is white and produced at its upper end toward the last-named spot; in the specimens I have seen the elytra are somewhat smaller and more velvety than in the allied species, but this may be exceptional.

Length 8–10 millim.

PUNJAB: Rawul Pindi; KASHMIR; SIKKIM: Kurseong; ASSAM; BENGAL: Nowatoli, Chota Nagpur; CENTRAL INDIA: Mhow; MADRAS: Mysore; CEYLON: Trincomali; BURMA: Pegu district.

131. Cicindela decempunctata, *Dej.*

Cicindela decempunctata, Dejean, Spec. Col. i, 1825, p. 145.
Cicindela modica, Gestro, Ann. Mus. Genova, 1893, p. 354.

Larger than the preceding species; front parts with more or less strong metallic reflection, elytra dark with hardly any metallic reflection and with the white spots distinct, or obscurely metallic with the light spots indistinct, without distinct brighter band at the sides; the latter form appears to be the *C. modica* of Gestro. Labrum dark with testaceous spots, or testaceous with the anterior margin dark: head long, with the eyes prominent, rather plainly but finely striated, occiput long, very finely sculptured; pronotum fully as long as, or rather longer than broad, with the impressions distinct and the central line feeble, very finely sculptured; at the sides there are white hairs, which are very plain in some specimens, but are easily rubbed off, and therefore are absent in others; elytra subparallel-sided in the male, slightly widened behind in the female, very finely sculptured, with the centre of the disc smooth, with five white spots on each, one at shoulders, a round one on disc before middle, two irregular ones at the middle (one near margin and one a little behind, nearer suture, sometimes joined by a thin line), and the fifth near apex joining a narrow marginal white line, which is continued to apex; legs metallic, trochanters reddish or pitchy red; underside cyaneous or green, with distinct pubescence at the sides, episterna of prosternum bare and impunctate.

Length 9–10 millim.

BENGAL: Birbhum, Murshidabad, Rajmahal; BURMA: Rangoon (*Bingham*), Palon (*Fea*); TONKIN; CAMBODIA.

The following insect ought perhaps to be placed in this section. Dr. Horn in his latest catalogue (Deutsche Ent. Zeitschr. 1905, p. 25) regards it as a subspecies of *C. germanica*, L., but in his 'Monograph of the Palæarctic CICINDELIDÆ' (1891) he placed it as a variety of *C. obliquefasciata*, Adams, which he now treats as a distinct subspecies of *C. germanica*, L. I think it best to follow his later work, but, so far as I have seen, *C. germanica* has the episterna of the metasternum bare, whereas the insect described below has them distinctly, though scantily, pubescent. Dr. Horn, however (Mon. Pal. Cic. p. 82), says that Schaum is wrong in saying that the sides of the underside of *C. germanica* are without hairs, as in fresh specimens separate hairs are sometimes visible on the upper edge of the episterna of the metasternum. The very large number of described varieties and subspecies of the commoner European species are somewhat bewildering, but it is only those workers, who, like Dr. Horn, have access to large numbers, that can decide their distinctness.

132. **Cicindela germanica**, *L.*, var. **kirilovi**, *Fisch.*

Cicindela germanica, Linnæus, Syst. Nat. ii, 1735, p. 657.
Cicindela kirilovi, Fischer, Bull. Soc. Moscou, 1844, p. 7, pl. 1, fig. 3.
Cicindela germanica, L., subsp. *obliquefasciata*, Adams, var. *kirilovi*, W. Horn, Mon. Pal. Cicind. 1891, p. 88, pl. iii, fig. 3 *a*.
Cicindela germanica, L., subsp. *kirilovi*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 28.

A rather small, dark species, with slight coppery and greenish reflections; labrum almost entirely testaceous; head broad, finely but distinctly striated between the eyes; pronotum parallel-sided, quadrate, very finely asperate, setose at the sides, with the central line and depressions not strong; elytra dull, almost black, but very slightly coppery, and with greenish shallow punctures, somewhat widened behind, obliquely and rectangularly truncate before apex (almost as in *Heptodonta*), with a spot on each at the shoulders, a fleck at about one-third from the base between the suture and the margin, an oblique waved fascia at the middle, and the apical margin, white; the latter marking is slightly produced towards the oblique fascia; underside green and cyaneous; abdomen and episterna of metasternum very scantily pubescent; genæ and prosternum bare.

Length. 11 millim.

KASHMIR; Gilgit; WESTERN SIBERIA; TURKESTAN; PERSIA.

"The priority-form occurs almost all over Europe from Spain to the Caucasus; in the north of Persia, in some parts of Turkestan (*e. g.* Tekke, Tashkend), Khirgiz and Dsongaria; the subsp. *kirilovi* does not occur in Europe, but is known from Transcaspia to the Kolyvan district, Altai and Dsongaria, from Turkestan, Kashmir, and almost the whole of Persia (up to Sarhad and Seistan in the south-east). The locality 'Daurien' (south-east of Transbaikalia), is doubtful" (Horn, Annotated List of Beetles in Indian Museum, i, p. 4).

133. Cicindela humillima, *Gestro.*

Cicindela humillima, Gestro, Ann. Mus. Genova, 1893, p. 353.

This species differs from its allies by its broader elytra and their irregular and sinuate outline in the female, in which sex they are abruptly widened at the anterior third; in the male the irregular outline is only just indicated; the pubescence of the underside is more marked, the episterna of the prosternum being distinctly, though scantily, furnished with long white hairs. I have examined a fair series, and find that the other differences pointed out by authors are valueless as characters.

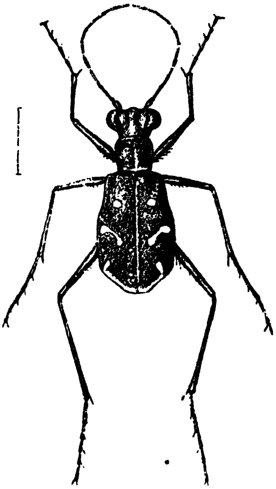

Fig. 155.—*Cicindela humillima* ♀.

Length 8½–9 millim.

Burma: Bhamo, Teinzo, Shwegoo, Katha, Rangoon (*Bligh & Fea*), Tharawaddy (*Corbett*).

Gestro (*l. c.*) says that this species was chiefly taken in the months of June, July, and August, at the time of the rainy season, on the banks of the Irawaddy, Burma, in shady places left in a marshy state after the subsidence of the river. Fea relates that it was so common that a single sweep of the net was sufficient to collect a large quantity: it was very abundant at Bhamo.

134. Cicindela sinica, *Fleut.*

Cicindela sinica, Fleutiaux, Ann. Soc. Ent. France, 1889, p. 137.

Of a dull green colour, with slight coppery reflections; head wavily striated between the eyes and transversely rugose; pronotum longer than broad, narrower at the base than in front, slightly rounded at the sides, finely granulose; elytra very gradually widened behind almost to apex and then abruptly rounded at apex, strongly and sparingly punctured, with the bottom of the punctures green; general colour of upperside dull green with a slight coppery reflection; markings small, according to the description, much as in *C. undulata*, but less numerous; underside and legs more or less coppery, trochanters ferruginous. The species is closely allied to *C. undulata*, but differs in being smaller, of a darker colour, and with the white elytral markings less numerous.

Length 10 millim.

BURMA: Taik-gyi, in Pegu (*Fea*, June); SAIGON (*Fleutiaux*); TONKIN: Chiem Hoa; CHINA (teste *Chaudoir*).

Only one example is known from the extreme limits of the Indian area.

135. Cicindela melancholica, *F.*

Cicindela melancholica, Fabricius, Ent. Syst. Suppl. 1798, p. 63; W. Horn, Mon. Pal. Cicind. 1891, p. 130, pl. iv, fig. 8, pl. v, fig. 40.

Allied to *C. leucoloma*, but distinguished by its more oblong form, the finer sculpture of the pronotum, and by having the pale elytral margin narrower and interrupted before and behind the middle; from *C. undulata* it may be known by the somewhat longer pronotum and by the more parallel-sided elytra; from *C. fastidiosa* it may be separated by the narrower and much less strongly rugose pronotum and narrower pale elytral margin. The general colour is dull greenish with slight coppery reflections, which are more evident on the elytra; legs metallic, with the tibiæ and tarsi reddish, and the trochanters red or ferruginous; the pubescence of the underside is very thick, almost tomentose at the sides, the centre of the whole body and the genæ being bare.

Length 9½–10 millim.

SIND: Karachi (*Bell*); BOMBAY: Bandra; CENTRAL PROVINCES: Nagpur; BENGAL.

The typical *C. melancholica* is a very widely spread insect and occurs in Europe, and throughout Africa and Palæarctic Asia; it is one of the very few cosmopolitan species which, like *C. aulica*, have penetrated to Southern Asia. It was described from Sierra Leone.

136. Cicindela undulata, *Dej.*

Cicindela undulata, Dejean, Spec. Col. i, 1825, p. 96.
Cicindela dubia, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 80.

This species may be distinguished from the two preceding by the fact of the female having a distinct, though not a very shining, smooth patch on the anterior portion of the disc of the elytra, and ordinarily by its much more attenuated white markings; these, however, are variable; the colour is usually obscure green, with more or less coppery reflection; labrum white; antennæ with the first four joints metallic and the rest more or less ferruginous or reddish; pronotum at least as long as broad, rather strongly and rugosely asperate, with the impressions and central line not strong; elytra in the typical form with a minute spot on the disc at the anterior fourth, the margin narrowly white for about the middle third, emitting at the middle a thin white line bent at the end nearest suture; there is a discoidal spot near the suture behind this, and the apical margin is white and produced linearly at its upper end; legs metallic, trochanters red; underside blue, greenish and coppery, thickly pubescent, genæ bare. The elytral markings are variable, and the shoulders may have no spot (this is not sexual) or a large distinct crescent.

Length 10–12 millim.

CEYLON; MADRAS: Mahé (*Maindron*), Chilka Lake, Mysore, Ramnad; CENTRAL INDIA: Gwalior; UNITED PROVINCES: Allahabad; BENGAL: Dacca, Calcutta, Chota Nagpur (Asansol, Lohardaga, Nowatoli); ASSAM: Sylhet; HONGKONG.

Var. **dubia**, *W. Horn.*

Smaller than the type-form and differing in having the smooth space or "mirror" on the elytra of the female brighter, and the elytra strongly rounded separately, so that the sutural spines are considerably projecting; the markings are almost the same as in *C. speculifera*, to which species it ought perhaps to be referred.

Length 10 millim.

INDIA (?).

Type in coll. Richter.

137. Cicindela imperfecta, *Chaud.*

Cicindela imperfecta, Chaudoir, Bull. Soc. Moscou, 1852, p. 8.
Cicindela atelesta, Chaudoir, l. c. 1854, p. 4.
Cicindela despecta, Fleutiaux, C. R. Soc. Ent. Belgique, 1886, p. 88 (*ex parte*).

Upperside brown, more or less coppery; labrum short, testaceous; head rather broad, very finely striate near the eyes, central and hinder portions very finely rugose; pronotum subquadrate, with the sides not rounded, impressions and central line distinct, pubescence at the sides coarse and distinct; elytra narrower and somewhat widened behind, very finely sculptured; the white markings are as follows: a spot at the shoulder more or less produced behind, a larger or smaller spot not far from the margin at about the anterior third, and the margin itself from a little before to some way behind the middle (the line being irregular and often interrupted); from this margin proceeds a transverse line, hooked before the suture; there is also a spot near the suture behind the middle, and another nearer the margin before the apex, which often meets the extended arm of the white apical marginal line; legs more or less coppery, trochanters dark metallic; underside coppery, with very distinct and long pubescence; the genæ, which are usually bare, being also furnished with long white hairs.

Length 11 millim.

MADRAS: Mysore; BOMBAY: Surat (Indian Museum); PUNJAB: Simla; BENGAL: Calcutta; CENTRAL PROVINCES: Nagpur.

Dr. Horn says that the species is known only from Bengal, and therefore some of these records may be erroneous: these obscure insects are very apt to be confused with one another.

Var. **atelesta**, *Chaud.*

Dr. Horn considers this as synonymous with the type, but the specimens I have seen are narrower, with red trochanters and with the ante-apical spot merged into the produced branch of the white apical margin, which is almost linear; the genæ apparently are not pubescent; the elytral markings are variable, but, as a whole, are smaller.

Length 10–10½ millim.

SIKKIM: Mungphu, Kurseong; BENGAL: Chota Nagpur, Nowatoli, Asansol, Calcutta; ASSAM: Sylhet (Ind. Mus.).

138. **Cicindela distinguenda**, *Dej.*

Cicindela distinguenda, Dejean, Spec. Col. i, 1825, p. 92.
Cicindela dohrni, Motschulsky, Étud. Ent. v, 1857, p. 109.
Cicindela distinguenda, var. *lunulata*, W. Horn, Deutsche Ent. Zeitschr. 1905, p. 35.

Front parts more or less coppery green or greenish, finely sculptured; head broad and flat between the moderately prominent eyes; labrum short, testaceous, leaving the chief part of the mandibles (which are dark except at base) exposed; pronotum subquadrate, distinctly, though finely, asperate, and not transversely strigose, slightly rounded at the sides, with the depressions and central line not strong and with evident pubescence at the margins; elytra a little rounded at the sides, dull, covered with very small round punctures, with a white marking on the shoulders followed by a spot on the disc, a bluntly hooked stripe at the middle proceeding from the margin, a spot near the suture towards the apex, and a spot touching the upper portion of the marginal white line at the suture, which is not linearly produced; legs metallic; underside green and violaceous, pubescent, centre of abdomen and the genæ bare.

Length 10–11 millim.

MADRAS: Pondicherry; CEYLON.

Apparently confused with *C. fastidiosa*, which it closely resembles and, perhaps, from much the same localities; in Fry's collection there is a smaller, darker, and more coppery example from Pondicherry.

Var. lunulata, *W. Horn.*

This newly described variety has the humeral crescent complete, and the elytra dark and more indistinctly punctured.
MADRAS.

The two following species are included somewhat doubtfully in this section, and they should probably form a separate section altogether. The first of them, *C. davisoni*, Gestro, is placed by Dr. Horn (Deutsche Ent. Zeitschr. 1905, Beiheft, p. 34) in his catalogue near to *C. humillima*, Gestro; Gestro appears, however, to regard it as representing a separate section of *Euryoda* (*Prothyma*). Only one specimen, apparently a female, is known, and this I have not seen. The second species, *C. prothymoides* (Horn, Stettin. Ent. Zeit. 1908, p. 120), is closely allied to *C. davisoni*, and, as its name implies, resembles closely the genus *Prothyma*.

139. **Cicindela davisoni**, *Gestro.*

Cicindela davisoni, Gestro, Ann. Mus. Genova, xxvii, 1889, p. 89

Elongate, cylindrical, æneous, with the forehead greenish æneous; antennæ fuscous, with the first four joints ferruginous at apex; labrum white, mandibles ferruginous; palpi white, with the last joint fuscous; sides of the pronotum and the cheeks obscurely cyaneous; elytra with two white spots on each, one at the shoulders and the other (transverse) at the apex, and also with a central oblique S-shaped white stripe; underside obscurely cyaneous; legs ferruginous. Head broad, eyes very prominent, the space between them being deeply impressed on both sides and rugosely striate, forehead rugose; pronotum very narrow, cylindrical, longer than broad, with the apical, basal, and central furrows well marked, and the surface finely and closely rugose; elytra elongate, parallel-sided, scarcely widened behind, punctured, the punctures at the sides being closer and confluent; legs long.
Length 7½ millim.
TENASSERIM: Thagata (*Fea*).

140. **Cicindela prothymoides**, *W. Horn.*

Cicindela prothymoides, W. Horn, Stettin. Ent. Zeit. 1908, p. 120.

Head, (including clypeus, genæ and forehead), pronotum and abdomen without hairs; elytra sloping towards the margin and coloured as in *Prothyma* and *Odontochila*, without spots.

The female differs from the female of *C. davisoni* in having the eyes a little more distant, the labrum longer, semicircularly produced in front, unidentate, in the middle more distinctly (but not acutely) carinate, and indistinctly margined in front; the forehead and pronotum are sculptured in the same fashion, but more finely; the anterior margin of the latter is slightly produced in the middle (in *C. davisoni* it is quite truncate), and the central portion, which in the last-named species is somewhat sloping, is flat and even; the elytra, moreover, have no white spots and are longer, more parallel-sided, and have the apex and the whole disc flatter, being more closely sculptured throughout, with the exception of the marginal portion, which is more finely, though scarcely more sparingly, punctured than the disc; the margins are, as a whole, more sparingly punctured than in *C. davisoni*, being sloping and obscurely cyaneous, as in *Prothyma* and *Odontochila*; the series of larger punctures near the suture is a little thicker than in *C. davisoni*, and punctures of the same character are irregularly scattered here and there over the elytra; the lateral portions of the pro- and meso-sternum as far as the coxæ are sparingly pilose, whereas in the preceding species they are without hairs, and the whole of the episterna of the metasternum are more or less sparingly and coarsely punctate-pilose; the anterior margin of the metasternum is narrowly, and the lateral portion broadly, punctate-pilose, as well as the exterior half of the posterior coxæ; the femora are coppery, shot with a greenish æneous reflection and clothed with testaceous hairs; the upper surface is obscurely coppery red and dull, whereas in *C. davisoni* it is browner and less coppery; the punctures of the elytra are not greenish blue as in that species, but concolorous with the disc, and the head and pronotum are more plainly margined with purple; the cheeks, the centre of the prosternum, the margins of the abdomen and part of the disc are bright violaceous, and the episterna of the mesosternum are obscurely æneous, the whole of the metasternum and part of the disc of the abdomen being variegated with brassy green; tibiæ brownish testaceous, tarsi brownish, trochanters testaceous.

Length 8–9 millim. (without labrum).

MADRAS: Karkur Ghat (*Andrewes*).

Horn (*l. c.*) speaks of the species as a very interesting one, which with *C. davisoni* forms a compact group, deriving its origin from the *Prothyma-Odontochila* forms, and leading up to the groups represented by *C. chloropleura* and *viridicincta*, *rugosiceps* and *corticata*, and *tetrastacta*, which are all allied to *C. germanica*; he also appears to consider *C. davisoni* as leading from *C. prothymoides* to *C. belli*, *C. viridilabris* and *C. triguttata*.

I have had the opportunity of seeing one of the few specimens known; superficially the insect is not unlike *Cicindela belli*, W. Horn.

GROUP 6.

Only one species is included by Dr. Horn in this group; it is very small (6–7 mm.) and has the underside furnished with distinct, but scanty and not tomentose, pubescence at the sides; the sides of the pronotum are set with hairs or setæ, and the genæ are scantily but distinctly pubescent. I have followed Dr. Horn in retaining this species in a separate section, although it might, perhaps, be referred to Group 5 as an exceptional case, like *C. imperfecta*, which also has the genæ more or less pubescent.

141. **Cicindela discreta,** *Schaum,* var. **reducta,** *W. Horn.*

Cicindela discreta, Schaum, Journ. Ent. viii, 1863, p. 59.
Cicindela reducta, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 370.

A very small and obscure-looking species; labrum rather large, produced in the middle, testaceous; head and pronotum greenish with coppery reflections, the former rather deeply excavate and striate, the latter long, subcylindrical and parallel-sided, very finely sculptured, with the central line not strongly marked; elytra duller, obscurely greenish with slight coppery reflection, comparatively narrow, distinctly sculptured, impressed within the shoulders, with a more or less triangular white spot in the centre of the margins and a white spot between this and the suture, and with the oblique apical margin narrowly white, the white portion being not, or very slightly, dilated at either end; legs and underside metallic green and violaceous, sides of the latter with scanty, and not tomentose, pubescence; genæ with sparse but distinct pubescence, which appears to be easily rubbed off.

Length 6–7 millim.

ASSAM (*Doherty*); BURMA: North Chin Hills; SUMATRA; BORNEO: Sarawak.

The type-form, which extends through the Malay Region to New Guinea, is not found in India; it is larger, with the pronotum broader and therefore shorter in proportion, and the elytra distinctly broader; the markings are different, as there is a white crescent at the shoulders (entirely wanting in the variety) and a distinct white spot before the apical margin, which is rarely joined to its upper extremity; the markings are evidently variable, for in a specimen of the type-form before me, from Celebes, there is no apical line at all, and the humeral crescent is divided into two quite distinct spots.

GROUP 7.

This group is made up of six or seven small species, 8–10 mm. in length; the sides of the pronotum are set with longer or shorter setæ, which occasionally invade the disc; the underside, except the central portion of the body, including the head and genæ, are clothed with white, usually thick and tomentose, pubescence; but in *C. mutata* this is, although distinct, comparatively thin; the markings in several cases are very distinct and intricate.

Key to the Species.

I. Elytra with the white or whitish testaceous margins very plainly interrupted in two or three places.
  i. Elytral markings very conspicuous.
    1. Head and pronotum bright metallic green .... *erudita,* Wied., p. 362.

2. Head and pronotum dark.
   A. Smaller and narrower; central fascia of elytra springing from the thin marginal pale line .... *grammophora*, Chaud., [p. 363.
   B. Larger and more robust: central fascia of elytra springing from a marginal spot or thickening .. *cognata*, Wied., p. 364.

ii. Elytral markings thin and often obscure.
   1. Length 9-9½ mm.: underside comparatively scantily pubescent...... *mutata*, Fleut., p. 365.
   2. Length 8-8½ mm: underside much more thickly pubescent .... *minuta*, Ol., p. 366.

II. Elytra with the light margins continuous from shoulder to apex, though nearly interrupted just before the oblique truncation of the apex.
   1. Setæ on the sides of the pronotum very long, invading the disc; central fascia of the elytra more strongly sinuate, and extended further towards apex: trochanters dark .... *nitida*, Wied., p. 366.
   2. Setæ on the sides of the pronotum shorter but well marked: central fascia of the elytra less strongly sinuate and much less extended towards apex: trochanters red or ferruginous.
      A. Elytra not, or scarcely, narrowed towards base; ground-colour brownish coppery .... *agnata*, Fleut., p. 367.
      B. Elytra narrowed towards base; ground-colour fuscous purple .... *sublacerata*, Solsky, var. *balucha*, Bates, p. 368.

142. Cicindela erudita, *Wied.*

Cicindela erudita, Wiedemann, Zool. Mag. ii, 1, 1823, p. 68.
Cicindela amabilis, Dejean, Spec. Col. v, 1831, p. 228.
Cicindela chloropus, Brullé, Arch. Mus. Paris, i, 1839, p. 134, pl. 9, fig. 2.

This is a beautiful little species which may be at once distinguished superficially by the brilliant green metallic colouring of the head and pronotum and the bold clear white markings of the elytra, the ground-colour of which is dull, very dark blue or blue-black with a more or less extended portion of the base metallic green; the pronotum has the sides slightly more rounded and the white hairs on the edge of the upperside rather shorter, but distinct, though apparently very fugitive; the elytral markings are broader than in the allied species (the irregular V-shaped central patch becoming a broad sinuate spot), and the apical marking is separated, the anterior portion being represented by a large round spot—this will at once distinguish the species apart from all else; the elytra are scarcely sculptured and almost smooth; the pubescence of the underside is thick and tomentose, as in the two succeeding species.

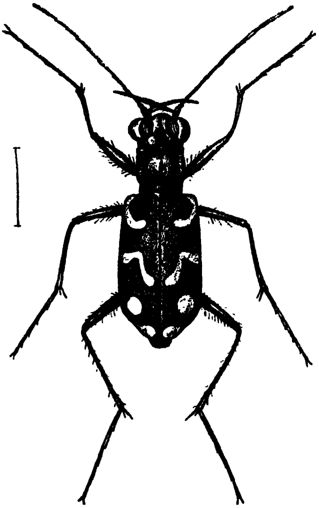

Fig. 156.—*Cicindela erudita.*

Length 9½–10 millim.

KASHMIR; PUNJAB: Kulu; UNITED PROVINCES: Agra, Allahabad; BENGAL: Maldah, Chota Nagpur, Pusa.

143. **Cicindela grammophora**, *Chaud.*

Cicindela grammophora, Chaudoir, Bull. Soc. Moscou, 1852, p. 7.

Labrum narrow, whitish testaceous; head and pronotum with more or less obscure green and coppery reflections, the former strongly striated on each side between the eyes; occiput and pronotum very finely granulate, dull, the latter rather narrow, about as long as broad, with the sides almost straight, white setæ distinct on each side on the upper surface; elytra dull, dark, usually with a more or less distinct greenish reflection at base, not closely, but distinctly, granulate, especially on the anterior portion; the margins are mostly whitish testaceous, being interrupted before the basal and apical markings; the white markings consist of a large crescent-shaped spot at the shoulders (which is produced behind towards the suture into a short thin line dilated into a round spot), a central inverted V-shaped marking springing from the marginal patch, with the inner lines produced and dilated towards the suture, where they nearly meet, and an apical marginal marking, which is dilated at the apical angle and at its other extremity is produced into a stalked spot; legs metallic, trochanters red; underside, except the central portion of the body and the head and genæ, thickly set with white tomentose pubescence.

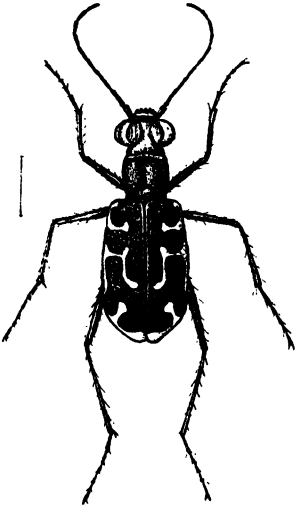

Fig. 157.—*Cicindela grammophora.*

Length 8–8½ millim.

Bengal: Maldah, Sara Ghat, Patna District, Goalbathan, Calcutta District, Pusa, Damukdia, Chota Nagpur, Asansol.

Known only from Bengal (*Horn*). A common species on the banks of the River Ganges. It flies to light at night on the river steamers, sometimes in considerable numbers (*Annandale*).

144. Cicindela cognata, *Wied.*

Cicindela cognata, Wiedemann, Zool. Mag. ii. 1, 1823, p. 66.
Cicindela triramosa, Kollar, Ann. Wien. Mus. i, 1836, p. 330.

Allied to the preceding, but larger and more robust and more brightly coloured, with the sculpture of the elytra stronger; the white markings are of the same character but are larger and thicker, and the central one proceeds from a dilated spot at the margin, and not from a long marginal patch as in *C. grammophora*; the apex is more abruptly truncate obliquely than in the latter species.

Length 9½–10 millim.

Sikkim: Darjiling; **Bengal**: Chota Nagpur, Asansol, Berhampur.

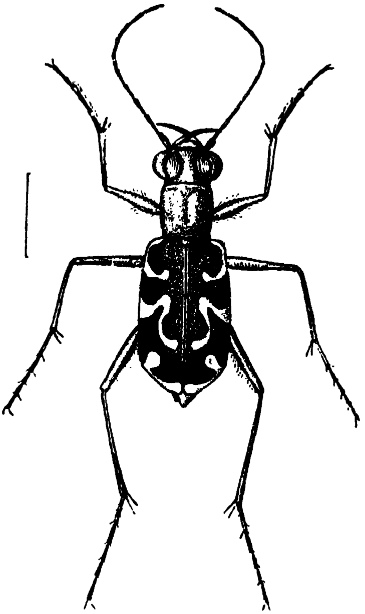

Fig. 158.—*Cicindela cognata.*

145. Cicindela mutata, *Fleut.*

Cicindela mutata, Fleutiaux, Ann. Soc. Ent. France, 1893, p. 486.
Cicindela cognata, Gestro (*nec* Wied.), Ann. Mus. Genova, 1893, p. 356.

This species is closely allied to *C. cognata*, Wied., with which it has been confused, but is a more obscurely coloured insect with a distinct dull obscure coppery or greenish coppery reflection, and the elytral markings, which are similar in character, thinner and less pronounced; the general sculpture and the shape of the pronotum are much the same, but the latter is very slightly shorter; the pubescence of the underside is much thinner and less tomentose, and the colouring of the underside is coppery and green, not blue and violaceous, as in *C. cognata*. It is quite a distinct species, and easily recognizable.

Length 9–9½ millim.

Burma: Bhamo, Teinzo, and Pegu (*Fea*), Tharawaddy (*Corbett*).

In one or two of the specimens before me the markings of the elytra are very obscure and hardly traceable.

146. Cicindela minuta, *Ol.*

Cicindela minuta, Olivier, Ent. ii, 1790, p. 31, pl. 2, fig. 13; Fabricius, Ent. Syst. i, 1792, p. 178.
Cicindela baltimorensis, Herbst, Käfer, x, 1800, p. 180, pl. 172, fig. 2.
Cicindela tremebunda, McLeay, Ann. Jav. 1825, p. 12.
Cicindela pumila, Dejean, Spec. Col. ii, 1826, p. 425.
Cicindela prinsepi, Saunders, Trans. Ent. Soc. Lond. 1834, p. 65, pl. 7, fig. 7.
Cicindela acuminata, Kollar, Ann. Wien. Mus. i, 1836, p. 331.

An obscure and insignificant-looking little species, of a dull olivaceous colour, with more or less distinct dull coppery reflections (rarely entirely obscure coppery), especially on the head and pronotum; head finely striate inside the eyes, somewhat excavate and with the central part more or less raised, occiput and pronotum very finely sculptured, the latter at least as long as broad, with the sides almost straight, and with distinct white hairs at the sides; elytra dull, somewhat widened behind, finely and closely, but distinctly, granulate, with the markings of much the same character as in *C. grammophora*, but much narrower, and occasionally very obscure; the light margin is interrupted behind the anterior crescent and before the posterior apical marking, the upper portion of which is distinctly produced and slightly clavate; the central marking is in the shape of a broad inverted **V**, the inner portion being reflexed and clavate towards the suture; legs metallic; underside bright green, occasionally coppery, metallic, with the sides strongly pubescent; genæ bare; trochanters metallic.

Length 8–8½ millim.

SIKKIM: Darjiling; BENGAL: Calcutta, Chota Nagpur, Chapra, Dacca, Berhampur; MADRAS: Pondicherry (*Maindron*); BURMA: Tharawaddy; INDO-CHINA; MALAY ARCHIPELAGO; CHINA.

Apparently an abundant species where it occurs. There is a very large series in the Indian Museum, labelled "Calcutta," showing very little variation.

147. Cicindela nitida, *Wied.*

Cicindela nitida, Wiedemann, Germ. Mag. Ent. iv, 1821, p. 117; Dejean, Spec. Col. i, 1825, p. 91.
Cicindela venosa, Kollar, Ann. Wien. Mus. i, 1836, p. 331.

A very distinct and pretty species, which, together with *C. agnata*, may be known from the three preceding species by having the whole of the margins of the elytra from the shoulder to the apex whitish testaceous, although much narrowed and almost broken before the posterior marking; of an obscure greenish colour with more or less distinct coppery reflections; labrum rather large, white; head broad between the eyes, rather strongly striated, with a raised line in the centre behind; occiput and pronotum very finely sculptured, the latter subquadrate with distinct long hairs at the sides; elytra much duller than the head and pronotum, finely and closely, but distinctly, punctured, apical portion cut off obliquely, spines at apical angles distinct; the markings are much more extended and wavy than in the preceding species, the central sinuate loop being continued down the suture until it almost meets the sutural extension of the apical marking, and the upper extension of the apical marking being also much extended towards the middle of the elytra and not, or very slightly, clavate; the central marking is sometimes frayed at the sides; legs and underside bright metallic green or coppery green, the latter tomentose at the sides; genæ bare; trochanters metallic.

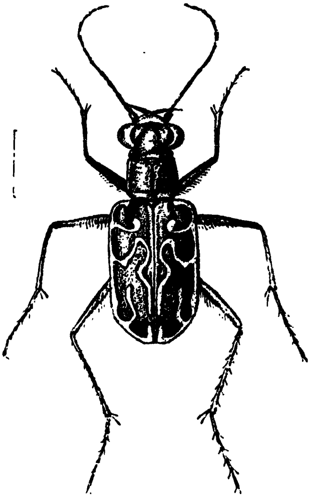

Fig. 159.—*Cicindela nitida.*

Length 8–9 millim.

Sind: Karachi (*Bell*); Sikkim: Kurseong, Darjiling; Bhutan; Bengal: Sara Ghat, Patna District, Calcutta, Maldah, Rajmahal, Asansol, Chota Nagpur; Madras: Pondicherry, Ramnad; Burma: Pegu: Cambodia.

On sandy river banks (*Westermann*); this is another of the species that flies to light on the river steamers.

148. **Cicindela agnata**, *Fleut.*

Cicindela agnata, Fleutiaux, C. R. Soc. Ent. Belgique, 1890, p. 68.

Larger than *C. nitida*, from which it is easily distinguished by its brownish coppery colour, longer and narrower pronotum, red trochanters, and different elytral markings, which are however of much the same character; labrum rather long, whitish testaceous, with a very distinct row of hairs on the anterior border; head very finely striated inside the eyes; pronotum rather longer than broad, with the sides straight, very finely sculptured, with well-marked white hairs at the sides; elytra very finely sculptured, with the suture coppery, markings broader than in *C. nitida*, and all, as in that species, connected with the light margin, the central inverted V-shaped marking being less produced behind and ending near the suture in a triangular club, and the posterior marking having its upper process much broader and more curved; legs and underside coppery green, the latter with very strong tomentose pubescence at the sides; genæ bare, trochanters red.

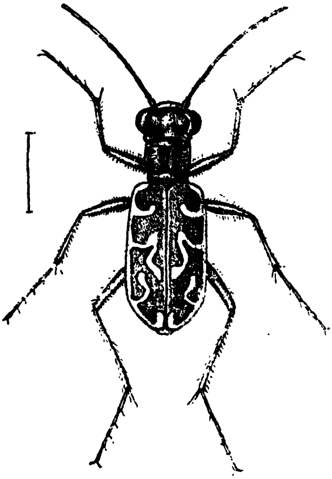

Fig. 160.—*Cicindela agnata.*

Length 9–10 millim.

Sikkim: Kurseong; Bengal: Balighai, near Puri, Orissa, Chota Nagpur, Asansol; Madras: Ramnad, Pondicherry.

Fleutiaux says that the female has a broader labrum with a black border in front, but in the only female I have seen the labrum is entirely whitish testaceous. The species appears to be most closely allied to the European species *C. trisignata.*

"This species occurs not uncommonly on the sand dunes of the Orissa coast, but not on the sea-shore, which is monopolized by *C. biramosa* to the exclusion of all other species. *C. agnata* is found in most localities, together with *C. cancellata.*" (*Annandale.*)

149. Cicindela sublacerata, *Solsky*, var. **balucha,** *Bates.*

Cicindela sublacerata, Solsky, Col. Turk. ii, 1874, p. 3.
Cicindela balucha, Bates, Cist. Ent. 1878, p. 332.

C. sublacerata appears to be a somewhat widely spread Palæ-

arctic species which has occurred in Turkestan and the Caucasus; it is an oblong, subcylindrical species, of an obscure greenish bronze colour, and the elytral markings are of much the same character as in the two preceding species, the margins also being continuously whitish testaceous. Dr. Horn appears to be right in treating *C. balucha*, Bates, as a subspecies or variety of this species. Bates compares it with *C. chiloleuca*, to which *C. sublacerata* is rather closely allied, but says it is much shorter and more obscurely coloured than that species. I have seen neither the type nor the variety, and append a translation of Bates's description of his specimens:—

"Fuscous-purple, with the elytra subovate, narrowed towards the base, with a humeral and apical crescent (the latter with the anterior horn clavate) and a central fascia strongly bent and dilacerate, yellow (the fascia and the humeral crescent being connected by the margin); head with the forehead coarsely striate, and the occiput granulate, together with the pronotum furnished with scanty incumbent pubescence; labrum (in the female) roundly produced as in *C. chiloleuca*, with the margin straight in the middle and with one tooth; antennæ with joints 5–11, the trochanters and the tibiæ (except the apex) obscurely red; breast greenish æneous."

Length, ♀, 8–8½ millim.

BALUCHISTAN; KASHMIR: Skardo.

The range of the species is very wide, according to Dr. Horn, embracing the Caucasus Mts., Armenia, Transcaspia, Turkestan (to Ferghana and the Pamirs), and North Persia to the frontiers of Baluchistan and Kashmir.

GROUP 8.

Moderate-sized species (12–15 mm., rarely smaller), with intricate markings; underside with all the sides, and the genæ, thickly clothed with white tomentose pubescence; male occasionally with a fascia of long setæ on the underside of the fourth joint of the antennæ; sides of pronotum with long white hairs, which encroach on the disc.

Key to the Species.

I. Male with a fascia of setæ on the underside of the fourth joint of the antennæ .... *anguiata*, F., p. 370.
II. Male without a fascia of setæ on the underside of the fourth joint of the antennæ.
  i. Ground-colour obscure dark bronze, with a more or less distinct greenish reflection; central markings of elytra large and well-marked, in the form of a sinuate inverted V .. *sumatrensis*, Herbst, p. 371.

ii. Ground-colour of elytra a rich dark brown; central marking of elytra short, rather broad, and transverse, with a round spot just below its apex, not far from the suture .... *cardoni*, Fleut., p. 372.

150. Cicindela angulata, *F.*

Cicindela angulata, Fabricius, Ent. Syst. Suppl. 1798, p. 62; Dejean, Spec. Col. i, 1825, p. 89; Schmidt-Goebel, Col. Faun. Birm. 1846, p. 4, pl. 1, fig. 8.
Cicindela latipennis, Parry, Trans. Ent. Soc. Lond. 1845, p. 84.
Var. *Cicindela plumigera*, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 86.

Longer and broader than *C. sumatrensis*, which it much resembles in colour and general markings and also in the pubescence of the underside; the latter, however, is closer, coarser, and thicker, and the hairs in front of the white labrum are also thicker and more conspicuous; the markings of the elytra are similar, but on a larger scale, and the granulation of the upper surface is stronger; the metallic reflection, also, is brighter. The chief distinction, however, lies in the fact that the male has, on the underside of the fourth joint of the antennæ, a very distinct solid fascia or plume of thickly-set hairs which stand out for some distance from the antennæ. The margins of the elytra in the female are sometimes irregular and sinuate; but this is not always the case, and is more marked in some specimens than in others.

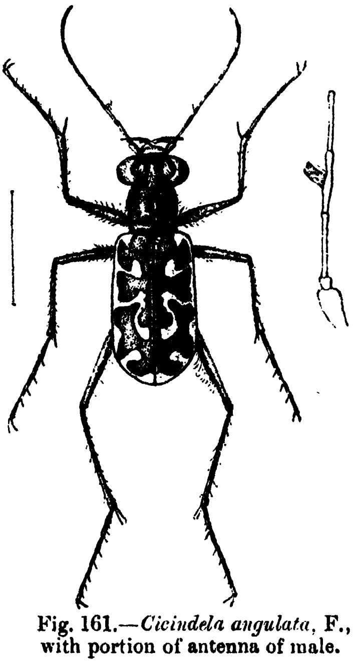

Fig. 161.—*Cicindela angulata*, F., with portion of antenna of male.

Length 12½–15 millim.

Sind: Karachi; Sikkim: Mungphu, Pankabari, Darjiling District; Bengal: Calcutta, Maldah, Damukdia, Tetara, Dacca, Chota Nagpur, Asansol; Burma: Pegu; Hainan; Annam.

Common on sandy river-banks (*Westermann*). This is another species that flies to light on the Ganges steamers (*Annandale*).

Var. plumigera, *W. Horn.*

Rather smaller and duller than the type-form, with shorter and more slender tarsi; forehead more finely striated between the eyes; pronotum distinctly more contracted before the base, which makes it appear shorter and broader; markings of the elytra much the same, but sometimes not quite so much pronounced; in the specimens I have seen, the colour is much darker and the white markings are more or less indistinct, but this may be due to external causes.

Length 13–14 millim.

MADRAS: Trichinopoli, Mysore, Nilgiri Hills.

In Mr. Nevinson's collection there is a quite black variety without markings, a female specimen from Formosa, which Dr. Horn assigns to this species as var. *devastata*; he possesses a black specimen in his own collection labelled "Raniganj."

151. Cicindela sumatrensis, *Hbst.*

Cicindela sumatrensis, Herbst, Käfer, x, 1800, p. 179, pl. 172, fig. 1.
Cicindela catena, var. *tertia*, Thunberg, Nov. Ins. Spec. 1784, p. 26, figs. 41–43.
Cicindela arcuata, Kollar, Ann. Wien. Mus. i, 1836, p. 330.
Cicindela boyeri, Blanchard, Voy. Pôle Sud, Ent. iv, 1853, p. 4, pl. i, fig. 2.
Cicindela niponensis, Bates, Trans. Ent. Soc. Lond. 1883, p. 216.
Cicindela renardi, Fleutiaux, C. R. Soc. Ent. Belgique, 1890, p. 69.
Cicindela imperfecta, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 173.

Obscurely bronze, with a coppery or greenish reflection, sometimes with the ground-colour almost black; labrum short, white, mandibles very large, very little covered, white, with the apex metallic; clypeus and front of head without pubescence; head depressed slightly on each side near eyes and raised a little in the middle, very finely sculptured, without any pubescence on the upper side; pronotum almost longer than broad, very finely sculptured, slightly rounded at the sides, with distinct pubescence on each side near margins; elytra much broader than pronotum, widened behind in the female, finely granulose and shagreened throughout, ground-colour dark brown or olive-green, with elaborate white or testaceous markings; the white colour extends from the shoulders to the apex, with an interruption before the apical lunulate patch, there is a transverse extension towards suture at about the first third, a large inverted V-shaped or reversed S-shaped (when

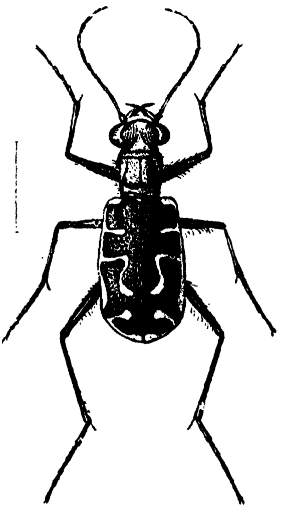

Fig. 162.—*Cicindela sumatrensis.*

the angle is more rounded) patch at middle extending backwards, and the apical patch is extended to meet this in a patch or line dilated at its upper extremity; legs metallic; underside metallic, with all the sides (including the genæ) very thickly clothed with long white tomentose pubescence.

Length 10½–14 millim.

CEYLON (*Horn*); MADRAS: Trivandrum, Travancore (*Annandale*), Mahé (*Maindron*); BOMBAY: Khandesh (*Bell*); SIND: Karachi (*Bell*); BENGAL: Calcutta, Ranchi, Damukdia (R. Ganges), Maldah, Chota Nagpur; NEPAL: Kumdhik, Maho, Nepal Terai (*Hodgart*); BURMA: Bhamo, Teinzo (*Fea*), N. Chin Hills, Tharawaddy (*Corbett*), Tavoy, Pegu; MALAY PENINSULA: Perak, etc.; SUMATRA; BORNEO; PHILIPPINE ISLANDS; HAINAN; CHINA; FORMOSA; JAPAN.

Var. **imperfecta**, *W. Horn.*

This variety differs from the typical form in being on the average smaller, and in having the white markings of the elytra much reduced and split up more or less into spots and patches; the large central fascia is reduced to a narrow transverse line, and the margin is much interrupted.

Length 10½–11¾ millim.

BOMBAY: North Kanara (*Bell*); MYSORE: Shimoga.

Var. **renardi**, *Fleut.*

According to M. Fleutiaux, this pretty variety, which rests on a unique example, differs from the type-form by its colour, which is bright bluish green above and bright blue on its underside; the legs are bright blue with a greenish reflection. It is of the same size, apparently, as the typical form.

BENGAL: Chota Nagpur, Asansol: ASSAM.

152. **Cicindela cardoni**, *Fleut.*

Cicindela cardoni, Fleutiaux, C. R. Soc. Ent. Belgique, 1890, p. 169.

Upper surface of a rich dark brown colour, with more or less distinct metallic reflections in parts, the base of the antennæ, the scutellum, and the base and suture of the elytra being usually bright coppery or greenish; labrum short, white; mandibles white at base, brilliantly metallic in the centre, black at apex; scutellum and front of head without pubescence, space between the eyes finely striated at the sides: pronotum almost quadrate, with the sides straight, finely and asperately punctured, dull, with rather thick and long pubescence at the sides; elytra with the upper surface granulose, the white margin extending from shoulder to apex, with an interruption a little before apex; there is a crescent-shaped spot at the shoulder, a short transverse band (jagged posteriorly) at about the middle, followed by a distinct, though not large, spot a little behind it near the suture; at the apex is a lunulate band, dilated inwards at each end; the plan of the markings is evidently the same as in the two preceding species, but they are abbreviated and broken; legs metallic, femora mostly coppery; underside golden green and coppery, with the sides throughout furnished with thick and long white pubescence.

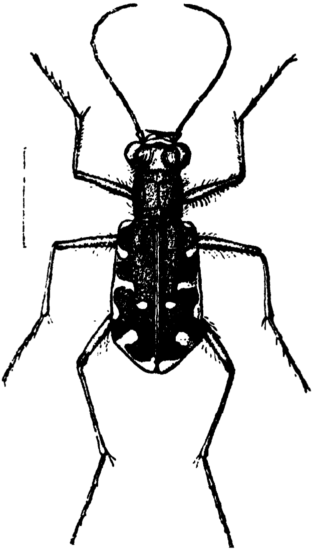

Fig. 163.—*Cicindela cardoni.*

Length 12–13½ millim.

Ceylon: Chilaw (*E. E. Green*); Madras: Pondicherry (*Maindron*), Mysore; Bombay: Kanara (*Bell*); Bengal: Chota Nagpur, Asansol and Nowatoli (*Cardon*); Sikkim; Burma.

Group 9.

Two closely allied species belong to this group; they are extremely variable in colour and markings, and have a very wide range in both Southern Europe and Asia. The underside, except in the middle, is clothed with not very thick pubescence, which is also present on the genæ; the clypeus is scantily pubescent, and the sides of the thorax are furnished with white setæ.

Key to the Species.

I. Tarsi longer	*aulica*, Dej., p. 373.
II. Tarsi shorter	*lunulata*, F., p. 375.

153. Cicindela aulica, *Dej.*

Cicindela aulica, Dejean, Spec. Col. v, 1831, p. 214; W. Horn, Mon. Pal. Cic. 1891, p. 155, pl. 6, fig. 4; id., Deutsche Ent. Zeitschr. 1891, p. 332.

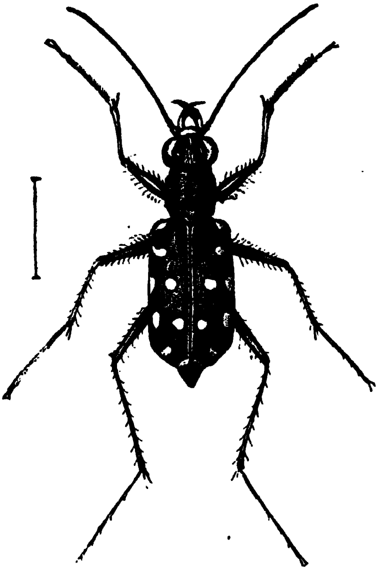

Fig. 164.—*Cicindela aulica.*

Very variable in colour; upper surface entirely brown, greenish blue, blue, or more or less dark coppery, or with the elytra dark olivaceous or almost black, with the sutural and basal parts and the head and pronotum coppery; each elytron has, when fully marked, a crescent-shaped spot at the shoulder, another lateral one at the middle, and a third at the apex, and two round white spots on the disc, one just at the middle and one nearer suture behind this; the lunulate lateral and apical patches are often divided, thus forming eight spots on each elytron; occasionally the central spots are confluent with the upper branch of the central crescent; labrum white; jaws large, dark, with a white patch at base; clypeus with scanty, but distinct, pubescence; head rather strongly striated; pronotum almost quadrate, but somewhat variable, being longer and narrower in some varieties than in others, very finely sculptured; elytra rather strongly punctured towards base, with larger punctures intermingled, smooth behind, with an impression inside the shoulders, and with the sutural region before base raised into a distinct hump-like prominence; legs metallic; underside metallic, shining; sides of the whole body, including genæ, clothed not very thickly with whitish pubescence.

Length 12½–14 millim.

SIND: Karachi; PERSIA; ARABIA; SOMALILAND; BENGUELA; SENEGAL; ABYSSINIA; EGYPT; CAPE VERDE ISLANDS; GREECE; ST. VINCENT.

Dr. W. Horn has kindly sent me the above list of localities for this widely distributed species.

A considerable number of examples have been taken at Karachi by Mr. Bell.

M. Maindron (Ann. Soc. Ent. France, 1899, p. 380), in speaking of this species, says that it was discovered originally in Senegal and has a very extended distribution in an oblique line from the north-east to the south-west. It is very common at Karachi, on the sands of the coast of the peninsula of Kiarnari, where they are rich in clay. The examples there captured are of small size, usually of a reddish-coppery colour, like those he took at Obock and Jibouti (French Somaliland) in 1893. Many are greenish, and some (and these the most rare) are completely green. All the transitions between the coppery type and the varieties are found at Karachi. These Indian specimens are always more slender, smaller, and more brightly coloured than those from Senegal and Tunis; they have always an inclination towards the greenish tint, whereas those from Obock are usually entirely reddish coppery. At Jibouti, and especially at Obock, M. Maindron has observed that *C. aulica* frequents places where the mud and sediment of fresh water meets the salt sands.

An entirely blue variety (both upper and under side), with the sutural angles of the elytra less drawn in, occurs in Persia, and has been named var. *diania* by Tschitscherine (Horæ Ross. xxxvi, 1903, p. 11). The thorax is said to be shorter, with the sides less rounded; but this is a very variable character in the species. I have three specimens of *C. aulica* from Karachi—one of which has the thorax distinctly longer than broad and almost parallel-sided; another has the thorax plainly broader, about as long as broad, with the sides slightly rounded; while the third is intermediate. In the description the var. *diania* is said to be an inland insect; but it has recently been found on the Persian Gulf, and very likely it occurs in India.

154. Cicindela lunulata, *F.*

Cicindela lunulata, Fabricius, Spec. Ins. i, 1781, p. 284.
Var. *Cicindela nemoralis*, Olivier, Ent. ii, 33, 1790, p. 13, pl. 3, fig. 36.

This, like *C. aulica*, is a very variable and very widely distributed species. It appears to differ mainly in the shorter tarsi and the shape of the male organ; this is much straighter in *C. aulica*, and much more curved and produced in *C. lunulata*; the elytra are somewhat less convex in *C. lunulata*, and the first joint of the antennæ is usually plainly stouter. The type-form is black; greenish or bronze specimens must be referred to the var. *nemoralis*, Ol. The elytral spots are much as in *C. aulica*, but appear to be more variable and are sometimes confined to the margin or almost disappear altogether.

Length 10–16 millim.

The type-form has occurred in the Nushki District, North Baluchistan, and the variety on the Perso-Baluch Frontier or Seistan.

The range is very wide, including the South of Spain, Morocco, Corsica and Sardinia, Sicily, Greece, Hungary, Germany, Silesia, Suez, and nearly all Central Asia to North China.

GROUP 10.

Sides of pronotum clothed with pubescence, which invades more or less of the disc; underside (except in the centre) and the genæ clothed with thick or very thick and long projecting pubescence; clypeus, at least at the sides, and the inferior internal margins of the eyes, pubescent. Length 10–14 mm.

Key to the Species.

I. Colour bright green; pubescence of the pronotum much shorter and more tomentose, and more projecting at the sides .... *chloris*, Hope, p. 376.
II. Colour brown or dull green; pubescence of the pronotum thinner and less tomentose, and less projecting at the sides.......... *funerea*, McL., p. 377.

155. Cicindela chloris, *Hope.*

Cicindela chloris, Hope, Gray's Zool. Miscell. 1831, p. 21.
Cicindela himaleyica, Redtenbacher, Hügel's Kaschmir, iv, 2, 1848, p. 497, pl. 23, fig. 1.

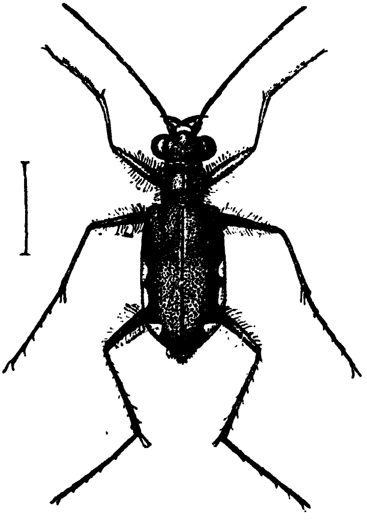

Fig. 165.—*Cicindela chloris.*

A bright green species; labrum testaceous; mandibles green, testaceous at base; clypeus and head at base of antennæ thickly pubescent; head striate between eyes, with a few white hairs on the surface, which are often rubbed off; pronotum green, with the sides and depressions blue or violaceous, slightly transverse, finely rugose, with thick and coarse pubescence at the sides; elytra much broader than pronotum, dull, granulose and shagreened throughout, with traces of two impressions on each between shoulder and suture, wider in the female than in the male, and less abruptly narrowed before apex, with the sutural angle much more strongly produced; disc and shoulders immaculate; at the margin about the middle there are two white spots joined by a thin line, very rarely broken, and before the apex a more or less comma-shaped spot; legs metallic; underside green and violaceous, with the whole of the sides of the abdomen, the episterna and the genæ thickly clothed with long white coarse pubescence.

Length 11½–12 millim.

KASHMIR: Gilgit; SIKKIM: Rungpo (*Hodgart*); NEPAL: Soondrijal, Benikhola, Kumdhik, Ghurwal District, Hathikund, and Jumnagwar; UNITED PROVINCES: Naini Tal District, Jalaban, Kumaon (Ammangarh and Patair).

Type in the British Museum; that of *himaleyica* in the Vienna Museum.

There is considerable confusion as to this insect, as Hope's type (so labelled) in the Oxford Museum is plainly *C. funerea* or one of its varieties, whereas the type in the British Museum, which Mr. Arrow tells me is the real type (from the Hardwicke collection), is the insect described above.

156. **Cicindela funerea**, *McL.*

Cicindela funerea, McLeay, Ann. Jav. 1825, p. 12.
Cicindela marginepunctata, Dejean, Spec. Col. ii, 1826, p. 428.
Cicindela assimilis, Hope, Gray's Zool. Miscell. 1831, p. 21.

Allied to *C. chloris*, but usually of a dull greenish bronze or greenish colour, or coppery brown with slight metallic reflections on the front parts, and with the sculpture of the elytra finer; the general form is rather broader and more robust, and the markings on the elytra are different; at the shoulders there is a distinct spot, which is wanting in the typical *C. chloris*, a transverse small marking in the middle and a longitudinal one behind this, both touching the margins and never joined, and a long lunulate patch reaching the apex; these vary in size, and occasionally there is one spot only before the apical lunule; the pubescence of the clypeus is only slight, and that of the underside is less thick and tomentose; underside mostly violaceous.

Length 12–14 millim.

MADRAS: Mysore; BOMBAY: Poona; W. BENGAL: Barway; PUNJAB: Simla; NEPAL; SIKKIM: Mungphu, Sukna, Pankabari, Kurseong; ASSAM: Sibsagar, Sylhet; BURMA: Tharawaddy, Allanmyo (*Corbett*), Teinzo, Pegu; TENASSERIM; PERAK; JAVA: INDO-CHINA; HAINAN; CELEBES.

The brown variety is the *C. assimilis* of Hope, according to Hope's type in the Oxford Museum, which, however, is in very bad condition. According to the types in the British Museum, which I am informed are the real types, both *C. funerea* and *C. assimilis* are brown insects, *C. funerea* having one small spot at the sides, besides the humeral spot and apical lunule, and *C. assimilis* two spots at the sides. I have examined a long series, and I believe that the brown and green varieties can be only separated on their colour, as the spots are variable. *C. opigrapha*, Dej., from Java, is apparently the same species, only with more markings at the sides. Horn considers this and another variety (*multinotata*, Schm.) as subspecies, but they only differ from the type in the spots: in both there are more spots, and in the var. *opigrapha* they are differently shaped from what they are in var. *multinotata*; neither of these, however, occurs in our region.

The species is mainly, if not entirely, confined to jungle.

Group 11.

This group contains only one species, a dark insect (10–11 mm. in length) with small white spots on the elytra; it is closely allied to the preceding, and differs in having the whole upper surface of the pronotum in fresh specimens covered with more or less distinct hairs. I at first included it under Group 10, but have followed Dr. Horn in separating it.

157. **Cicindela albopunctata**, *Chaud.*

Cicindela albopunctata, Chaudoir, Bull. Soc. Moscou, 1852, p. 10.
Cicindela olivia, Bates, Cist. Ent. 1878, p. 330.

Dark, with a slight metallic reflection, sometimes slightly olivaceous, dull; labrum comparatively short, whitish, maxillary palpi metallic, labial palpi testaceous, with the apex dark; clypeus pubescent at the sides; head very finely sculptured, the striæ between the eyes being scarcely apparent, except under a fairly strong lens; pronotum not transverse, with the sides almost parallel, and the whole upper surface more or less pubescent in fresh specimens, the under surface and the genæ with long thick white pubescence, very finely sculptured, central line scarcely marked; elytra much broader at base than the pronotum, broadly depressed just inside the shoulders, widened behind, plainly granulose throughout, with a crescent-shaped spot at shoulders and three other markings on each touching the margin, the apical one consisting of two prominences joined by a line; on the disc of each elytron are two nearly round small spots, one before and one behind the middle; legs metallic; underside, except in the middle, clothed throughout with dense white pubescence.

Length 10–11 millim.

Punjab: Simla (*teste Chaudoir*), Kangra Valley (*Dudgeon*); United Provinces: Mussoori, Moradabad, Chamusuri (*teste Bates*); Nepal; Sikkim: Kurseong (*Bretandeau*), Darjiling, Mungphu, Ghoom; Bhutan.

GROUP 12.

Brightly coloured species, of moderate size (14–15 mm., rarely smaller), forming a transition to the old genus *Calochroa*; sides of pronotum with a few very fugitive setæ; under surface with the sides not thickly pubescent; centre of the episterna of the metasternum almost bare; genæ with a few scattered hairs.

Key to the Species.

I. Pronotum a little shorter, with the sides straighter, coppery, with the margins green, blue, and violaceous; elytra dull, olive-green, with the suture coppery, and with the spots smaller and more numerous, finely but distinctly sculptured .... *intermedia*, Chaud., p. 379.

II. Pronotum a little longer, with the sides slightly narrowed before base, bright metallic green, with the central line and margins blue and violaceous; elytra dark blue or greenish, with the suture brilliant blue or green, and with three conspicuous spots only on each, besides the small humeral spot; sculpture scarcely traceable .... *oberthuri*, Fleut., p. 380.

158. **Cicindela intermedia,** *Chaud.*

Cicindela intermedia, Chaudoir, Bull. Soc. Moscou, 1852, p. 6.

A moderate-sized species; labrum testaceous, with the margins dark, rather short, mandibles testaceous with black tip; maxillary palpi metallic, labial palpi testaceous with dark apex; head and pronotum bright metallic, but not very shiny, green, violaceous or coppery, variable; head rather strongly striate between the eyes; pronotum very slightly transverse, with the sides straight, gradually and feebly narrowed to base, with the basal prominences well marked and with distinct pubescence at the sides; scutellum bright blue or green; elytra much broader than pronotum, with the sides slightly rounded, sutural angle with a distinct spine in the female, upper surface finely shagreened, dull olivaceous green or bluish green, with the suture and extreme base coppery, and the apex and external margins metallic green or blue; there is a white spot at the shoulders, which are well marked, and four others on each elytron, three in a longitudinal row near the margin, and a small one just behind the middle one and near the suture; the two latter are rarely joined; underside shining green and violaceous, and the sides, including the sides of the episterna of the metasternum, not thickly pubescent; femora metallic, tibiæ and tarsi dark; genæ with a few white hairs.

Length 14–15 millim.

KASHMIR: Jhelam Valley (*Bell*); PUNJAB; ASSAM.

159. **Cicindela oberthuri**, *Fleut.*

Cicindela oberthuri, Fleutiaux, Bull. Soc. Ent. France, 1893, p. cccxvi.

Labrum testaceous, with dark margins; head blue or green, strongly striated between the eyes; pronotum subquadrate, slightly narrowed to the base, with fine rugose sculpture, bright green, with the central line and margins blue and violaceous, sides with very scanty pubescence; elytra more parallel-sided in the male than in the female, dull, dark blue or greenish, with the suture, and more or less of the base and apex, shining blue or green; there is a small round white spot at the shoulder and three on the disc, one behind the other, the basal or apical ones being more or less round and the central one oblique and irregular; legs brightly metallic: underside with distinct but scanty pubescence at the sides, the episterna of the metasternum being pubescent on the upper part and at the sides, and the genæ being furnished with a few white hairs.

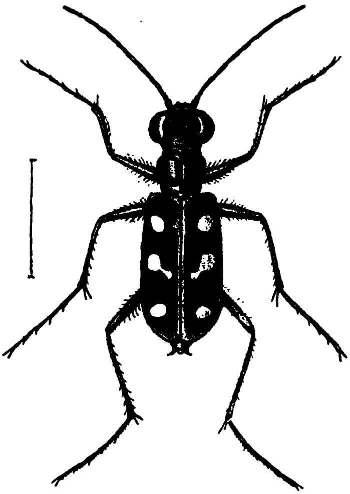

Fig. 166.—*Cicindela oberthuri.*

Length 13–15 millim.

Bengal; Sikkim: Mungphu, Kurseong.

This species at first sight looks like a blue variety of *C. aurulenta*, with which it has much in common; the pubescence, however, of the episterna of the metasternum and of the genæ will serve to distinguish it. I found a single specimen in the Indian Museum collection mixed with the var. *flavovittata* of *C. aurulenta.*

Group 13.

Large or moderately large, more or less brilliantly coloured, conspicuous species; sides of the pronotum practically without pubescence or setæ except at the posterior angles; underside with thick pubescence at the sides; episterna of metasternum scantily pilose or almost bare; genæ very scantily pubescent or almost or quite bare.

Key to the Species.

I. Length 20-25 mm.; spots on elytra very large and conspicuous .... *octonotata*, Wied., p. 381.

II. Length 15–18 mm.; spots on elytra less conspicuous.
  1. Pronotum subquadrate, slightly narrowed towards base; central discoidal markings straight and linear, reaching almost from the margin to the suture, anterior discoidal spot very small, if present, much smaller than the apical spot .... *duponti*, Dej., p. 382.
  2. Pronotum almost square, with the sides straight; central discoidal markings broader towards margin than towards suture, anterior discoidal spot rather large, about the same size as the apical spot .... *aurulenta*, F., p, 383.

160. Cicindela octonotata, *Wied.*

Cicindela octonotata, Wiedemann, Zool. Mag. i, 3, 1819, p. 168; Dejean, Spec. Col. i, 1825, p. 45.

A very large and beautiful species, one of the most brilliantly coloured of the genus. Labrum testaceous, with the base dark, mandibles testaceous with the apical part more or less dark, clypeus metallic blue or green; head and pronotum coppery, golden, blue and green, the former depressed and striated between the eyes, the depression being furnished with two short and broad violaceous stripes in front, the margins being of the same colour, sides without pubescence; pronotum almost quadrate, parallel-sided, blue or green in the centre, then coppery, sides and depressions blue or green: elytra deep velvety blue, with the suture, sides and apex, and a spot at suture in front of middle, brilliant green, and the extreme base coppery red and green; there is a large yellow spot at the shoulders, and three other large ones on each side (so that the elytra appear to be barred with yellow and blue), one behind shoulders and one at apex, round, and a central one, which is sometimes irregularly transverse and sometimes contracted in the middle; femora brilliantly metallic, tibiæ and tarsi cyaneous or violaceous; underside blue and green with the centre sometimes coppery, with thick pubescence at the sides, the episterna of the metasternum being scantily pilose; the genæ are bare, except for a few scanty hairs near their inner margins.

Length 20–25 millim.

Punjab: Simla; United Provinces: Agra; Bengal: Dacca, Asansol, Maldah, Pusa, Murshidabad, Ganges R.; Sikkim: Pankabari; Assam: Lushai Hills, Sibsagar, Sylhet, Khasi Hills, N. Manipur; Burma: N. Chin Hills, Tharawaddy and Jamayi (*Corbett*), Pegu.

Apparently plentiful where it occurs, and widely distributed in Northern India, Assam, and Burma. On the stony river-beds of the Sunkas, Raidak, etc., in North Assam (*Stebbing*). On the argillaceous banks of the Ganges River (*Westermann*). On sandy banks of a jungle stream at the base of the E. Himalayas (*Annandale*).

161. Cicindela duponti, *Dej.*

Cicindela duponti, Dejean, Spec. Col. ii, 1826, p. 419.
Cicindela barmanica, Gestro, Ann. Mus. Genova, 1893, p. 360.

A rather large and conspicuous species. Labrum dark, with testaceous patches; head metallic green, with the sides of the depressed portion between the eyes, and two short longitudinal bands at the base, violaceous, striation well-marked; pronotum green, with the centre, sides, and anterior and posterior depressions violaceous, subquadrate, very slightly narrowed towards the base, finely sculptured, without pubescence on the upper surface; elytra velvety, dark, with the suture, sides, and a common band or patch at or about the anterior third, green, or more or less blue, but the colour and pattern vary; on each there are two small, more or less transverse, white markings, one just behind the middle, and one nearer the apex, and besides these a small spot is often present at about the basal third near the suture; the sculpture is fine; legs brilliant blue, green or violaceous; underside of the same colour, with the sides of the body pubescent, the pubescence being very scanty on the genæ, the episterna of the metasternum, and the apical segment of the abdomen, and apparently easily rubbed off.

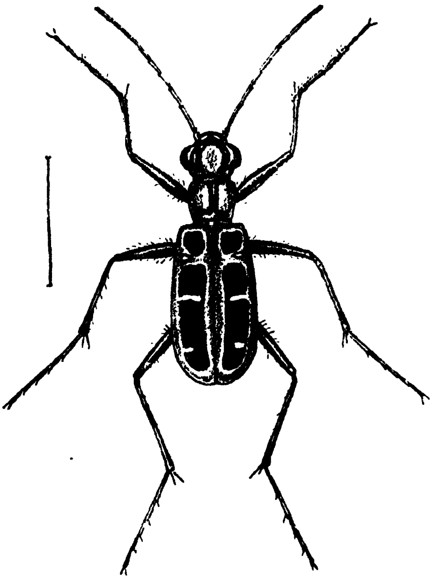

Fig. 167.—*Cicindela duponti.*

Length 16–18 millim.

Madras: Mahé, Trivandrum, Mysore; Bombay: Kanara; Bengal; Chota Nagpur, Dacca; Assam: Khasi Hills (Shillong, Cherra Poonji, Nonpriang, Maupun), Patkai Hills; Burma: Arakan, North Chin Hills, Pegu; Penang; Cochin China.

This species at first sight resembles *C. chinensis*, but is smaller and proportionately narrower, and the colour and markings are different, the latter being on a smaller scale.

Var. **barmanica**, *Gestro.*

This variety at first sight looks more like *C. aurulenta* than *C. duponti*, but the elytral markings are those of *C. duponti*, and the sides of the pronotum are a little straighter, as in the last-named species. The green colour throughout is replaced by golden coppery, which is broader and extends all round the sides and broadly down the suture; the femora are brilliant coppery green and blue; the pubescence on the underside is the same as in the type-form.

Madras: Nilgiri Hills (*H. L. Andrewes*); Assam: Sylhet, North Manipur; Burma: Karen Hills (*Fea*), Tharawaddy (*Corbett*), Pegu (*Fea*).

"This variety occurs occasionally everywhere with the priority-form, more frequently in the eastern localities" (*Horn*).

C. chinensis, De Geer, has been recorded from Simla, but this is most probably incorrect. No history is attached to the two specimens which are in the Indian Museum.

162. Cicindela aurulenta, *F.*

Cicindela aurulenta, Fabricius, Syst. El. i, 1801, p. 239; Dejean, Spec. Col. i, 1825, p. 46.
Cicindela flavomaculata, Chevrolat, Rev. Zool. 1845, p. 98.
Cicindela virgula, Fleutiaux, Bull. Soc. Ent. France, 1893, p. 491.

A rather large and variable species. Labrum testaceous, with the margins and centre dark; head plainly striate between the eyes and finely rugose transversely, metallic green, blue and coppery, the sides and two longitudinal short bands at the base being usually blue; pronotum almost square, with the sides straight, the centre, sides and depressions green and blue and the rest brilliant coppery, sides with scanty pubescence; elytra considerably broader than the pronotum, dark blue, dull and velvety, with the suture rather broadly coppery and the apex and extreme margins metallic, usually green or blue; there is a whitish spot at the shoulder and three others on each elytron, the front and hind ones being more or less round, but varying in size, and the central one varying from a large, transverse or almost round patch to a mere line; femora metallic, variegated; tibiæ, tarsi, and first four joints of antennæ cyaneous; underside brilliant metallic, usually green or violaceous, with the sterna and sides pubescent, the episterna of the metasternum being very scantily pubescent and often almost bare; the genæ are bare.

Length 15–18 millim.

CEYLON; BENGAL: Chota Nagpur; SIKKIM: Mungphu; BURMA: Karen Hills, Tavoy, Tenasserim, Pegu; MALAY PENINSULA: Singapore; SUMATRA; JAVA; BORNEO: Sarawak; NIAS; BANGAY ISLAND; CAMBODIA; SIAM; SOUTH CHINA; FORMOSA.

"In the eastern Siamese Malay States this is a very common species, occurring at an altitude of 3000 feet, but being more abundant in the plains. It is not a maritime species, but frequents open plains, preferably of a sandy nature, where vegetation is scanty." (*Annandale.*)

Var. **virgula**, *Fleut.*

This variety has the elytral spots smaller and the central one more or less comma-shaped, the tail of the comma turning towards the apex.

NORTH BENGAL; NEPAL; SIKKIM: Rungpo (*Hodgart*), Kurseong, Mungphu, Darjiling district; BHUTAN: Buxa, frontier of E. Bengal; ASSAM: Sylhet, Sibsagar, Naga Hills; BURMA: Teinzo; CHINA: Hong-Kong, Shanghai.

Var. **flavomaculata**, *Chevr.*

This variety has the spots much larger and rounder, covering a great part of the elytra; at first sight it appears quite a different insect from the var. *virgula.*

SIKKIM: Mungphu; BURMA, Pegu; TENASSERIM; TONKIN; CHINA: Macao, Hong-Kong.

Occasionally the coppery colour in *C. aurulenta* is replaced by green, and the general colour may be blackish green with green metallic markings.

GROUP 14.

Moderately large species (13½–15 mm.); sides of pronotum without setæ; underside almost bare, smooth, and shining.

Key to the Species.

I. **Unicolorous bright green (rarely blue), shining, with a very small white spot on each elytron at about the middle ....**	***whithilli*, Hope, p. 385.**
II. **Elytra very dark blue, dull, with a regular longitudinal row of three spots on each ..**	***sexpunctata*, F., p. 385.**

163. Cicindela whitbilli, *Hope.*

Cicindela whithilli, Hope, Col. Man. ii, 1838, p. 23.

Variable both in size and colour; usually green, with the front parts green or blue, but the colour varies from bright blue to almost dull black; labrum metallic at sides, dark in the centre; head very finely sculptured; pronotum almost quadrate with the sides straight, finely transversely rugose in the centre, asperate at the sides, basal depression deep, sides without pubescence; elytra more or less dull, with the suture and sides brilliant green, immaculate, with the exception of a minute white spot on each just at the middle, upper surface finely shagreened, smooth on disc before the apex; legs and base of antennæ metallic; the female is larger than the male and has the elytra wider; underside brilliant metallic green, practically bare; sides of abdomen with very scanty pubescence.

Length 13½–18 millim.

MADRAS: Travancore, Anaimalai Hills and Nilgiri Hills (*H. L. Andrewes*), Utakamand, Mahé (*Maindron*); BOMBAY: Wynaad, Kanara (*Bell*), Belgaum and Khanapur (*H. E. Andrewes*), Poona; BURMA: Tharawaddy (*Corbett*).

Mr. Bell says, "found in paddyfields round Haligál with *C. sexpunctata* in the June rains, the latter being much more numerous, in the proportion of ten to one." Mr. Leslie Andrewes says, "Anaimalais, May, 3000–4000 feet; flying and running on sandy road. Nilgiris, May and June, 3500–6000 feet; on dusty roads."

"Mr. Bell found this species only in one or two parts of Southern Bombay, near the rivers: the insects 'just jostled one another' sitting carpeting the ground in patches, among them a few of other species." (*Horn.*)

164. Cicindela sexpunctata, *F.*

Cicindela sexpunctata, Fabricius, Syst. Ent. 1775, p. 226; Dejean, Spec. Col. i, 1825, p. 47.
Calochroma sexpunctata, Motschulsky, Etud. Ent. xi, 1862, p. 22.

A moderate-sized, dark velvety species. Labrum short, more or less dark, mandibles mostly uncovered, metallic or dark, light at base; head and pronotum with very obscure metallic reflections, blue or green at the sides, the former often with two longitudinal metallic stripes below the eyes, very finely sculptured, the striation being extremely fine; pronotum quadrangular, with the impressions and central line distinct, and with a bright metallic callosity at each end of the basal one, quite bare at the sides, extremely finely transversely striated; elytra with the sides somewhat rounded, velvety, with the sides and suture narrowly bright green or blue, very finely shagreened, with three white or yellowish spots on each of about the same size, arranged in a line, at regular intervals, the first and third at about equal distances from the base and apex, and the second about the middle; these vary in size collectively to a certain extent, but not in the same individual; femora metallic, green or violet, tibiæ and tarsi more or less pitchy; underside bright green or violaceous, sides of abdomen with scanty pubescence; episterna of metasternum bare, except at the inner apical corner.

Length 13½–16 millim.

CEYLON; MADRAS: Bangalore; BOMBAY; Poona; BENGAL: Calcutta, Sunderbunds, Bosondhar, Berhampur, Birbhum, Raniganj, Damukdia, Purneah, Maldah, Behar, Alipur, Sara Ghat, Chota Nagpur, &c.; KASHMIR; SIKKIM: Mungphu; BURMA: Rangoon, Pegu, Sittaung River; SIAM; ANDAMAN ISLANDS; CAMBODIA; ANNAM; CHINA; FORMOSA; PHILIPPINE ISLANDS; SENEGAL.

There is a specimen in the Calcutta Museum sent by the subdivisional officer of Diamond Harbour, Hugli River, labelled "Sansi insects, said to eat the stems of plants," but as a matter of fact, it is a beneficial insect, destroying the "rice-sapper" (*Leptocorisa acuta*) which is a destructive pest in the rice-fields.

The occurrence of the insect in Senegal is very remarkable.

GROUP 15.

Closely allied to the preceding group, but with distinct setæ at the sides of the pronotum, and with the pubescence of the underside rather more pronounced. One species only.

165. **Cicindela aurovittata**, *Brul.*

Cicindela aurovittata, Brullé, Arch. Mus. Paris, i, 1838, p. 127, pl. 8, fig. 3.

This has been regarded as a variety of *C. sexpunctata*, which it closely resembles in general appearance, and it is possible that it may be only a local race of that species, although it seems to be distinct; it may be known by the coppery colour of the suture, and the broader, green and coppery sides of the pronotum and the elytra; the best distinguishing character, however, lies in the setæ on the sides of the pronotum, and the comparatively strong sculpture of the metallic margins of the elytra; the head and pronotum, too, are more evidently, though very finely, sculptured, and the latter is longer; the general form is a little more slender but in this respect *C. sexpunctata* is somewhat variable.

Length 12–14 millim.

MADRAS: Pondicherry; CEYLON (*Horn*); ANDAMAN ISLANDS; NICOBAR ISLANDS; BURMA: Rangoon; PHILIPPINE ISLANDS.

The species has been recorded from Central Japan, but Dr. Horn considers this locality to be very doubtful.

I have examined a large number of *C. sexpunctata*, and the pubescence on the sides of the pronotum is always absent. I have seen one apparently fresh specimen of *C. aurovittata*, with no pubescence either on the pronotum or abdomen, but it probably has been rubbed off; the pubescence on the former is present in all the other examples I have seen.

Group 16.

This is a very difficult group to define, and is, as here constituted, made up of three groups which have been separated by Dr. Horn, chiefly on the presence or absence of setæ on the sides of the pronotum; these, however, are in several cases scanty and fugitive, and hence confusion has already arisen, more especially as some of the species are very rare, and a series is necessary for the definition of the characters depending on pubescence. The *C. mouhoti* group with the various varieties and subspecies is especially difficult, some of the species having setæ present and others being entirely without them. I have thought it best therefore to throw them all together and to draw up a table resting chiefly on the differences in the markings, which are very constant; the pubescence of the underside is more or less scanty on the sides of the abdomen, and the episterna are bare, at least at the sides, and usually almost entirely bare; the genæ are also bare; the species, as a rule, are parallel-sided, with the pronotum subquadrate, and the elytra oblong with well-marked shoulders.

I have omitted from the following table *C. lauræ*, Gestro (p. 394), which I have not seen (it appears to be near *C. mouhoti*, from which it may be known by its longer and narrower pronotum), and *C. tritoma*, Schm.-Goeb. (p. 394), which I cannot identify with certainty; it is quite distinct from the *C. tritoma* of Gestro, which is synonymous with *C. goebeli*, W. Horn, which Dr. Horn now regards as a subspecies of *mouhoti*. Dr. Horn places *C. tritoma*, Schm.-Goeb., in a section distinguished by having no setæ at the sides of the pronotum, but in two specimens in the Calcutta Museum labelled *C. tritoma*, these setæ are very distinct; these ought perhaps to be referred to *C. mariæ*, and, if so, I have not seen a typical *C. tritoma*.

Dr. Horn has been most kind in helping me with this difficult section by sending me several of his unique types, and examples of rare species.

Key to the Species.

I. Pronotum longer than broad, subcylindrical, without setæ at the sides, and with the depressions in front and behind not strongly marked.
  i. Elytra with a regular yellow longitudinal band extending from the base nearly to the apex; form narrower; pronotum longer .... ***hamiltoniana*, Thoms.,** [p. 390.

ii. Elytra with a longitudinal patch on each side of the scutellum, followed by three spots one behind the other, the markings being sometimes reduced to narrow lines or linear patches (var. *lacrymans*, Schaum); form broader; pronotum shorter .... *discrepans*, Walk., p. 389.

II. Pronotum subquadrate, at most as long as broad.

i. Abdomen with the apex metallic or dark.

1. Elytra with a longitudinal yellow band on each reaching beyond middle.

A. Labrum testaceous with dark margins; elytra rather bright green with the markings more linear and regular .... *interrupto-fasciata*, [Schm.-Goeb., p. 399.

B. Labrum almost entirely dark; elytra almost black with the markings broader and irregular .... *mouhoti* var. *bramani*, [Dokht., p. 396.

2. Elytra with an oblique or crescent-shaped or sinuate yellow patch proceeding from the shoulders, or from the neighbourhood of the scutellum, and not reaching the middle; humeral spot often present.

A. Elytra with two oblique linear patches on each in front, one at base and one in the middle, roughly forming an X with separated arms, and with a straight longitudinal patch before apex .... *andrewesi*, W. Horn, [p. 392.

B. Elytra with a sinuate patch at base, followed by two spots, one at middle and one larger or smaller before apex.

a. Apical spot very small .... *mauritii*, W. Horn, [p. 392.

b. Apical spot large.

*a**. Length 12–15 mm.; pronotum with distinct setæ at the sides *mariæ*, Gestro, p. 401.

*b**. Length 15–19 mm.; pronotum without or with indistinct setæ at the sides.

a†. Head and pronotum dark (green or black).

a‡. Form broader; elytra more or less brightly cyaneous or violaceous blue .... *mouhoti*, Chaud., p. 395.

b‡. Form narrower; elytra black .... *mouhoti* var. *goebeli*, W. [Horn, p. 397.

b†. **Head and pronotum brilliant coppery red; size very variable (14–19 mm.)** .... *mouhoti* var. ***cariana***, [**Gestro, p. 398.**

3. Elytra with a single discoidal spot humeral spot large, small, or absent.
  A. Colouring of labrum, clypeus and front of forehead very conspicuous, golden coppery, genæ bright golden green; elytra black, dull, with a small yellow spot at the shoulders, and a large semi-crescent-shaped spot of the same colour at about the middle .... *corbetti*, W. Horn, p. 402.
  B. Colouring of labrum, clypeus and front of forehead not conspicuous.
    a. Elytra broader, with a large oblong spot at the shoulders and a single large round spot at about the middle .... *assamensis*, Parry, p. 395.
    b. Elytra narrower with a single large oblique spot just behind the middle .... *unica*, Fleut., p. 393.
4. Elytra with three discoidal spots on each, arranged longitudially at regular intervals; humeral spot small or absent.
  A. Elytra shorter and less parallel-sided, with smaller spots; head less finely striated.................. *octogramma*, Chaud., p. 404.
  B. Elytra longer and more parallel-sided with larger spots; head more finely striated .... *fabricii*, W. Horn, p. 403.
5. Elytra with a larger or smaller spot at the shoulder on each, another transverse and somewhat irregular just behind the middle, and a third before apex, the anterior half being unicolorous black, except for the humeral spot .... *mouhoti* var. *anometallescens*, W. Horn, p. 398.
ii. Abdomen with the apex broadly red.
  1. Elytra with a small spot at the shoulders and two large round spots on each, one at middle and one before apex .... *hæmorrhoidalis*, Wied., p. 402.
  2. Elytra unicolorous, dark greenish cyaneous or bluish................ *bicolor*, F., p. 400.

166. Cicindela discrepans, *Walk.*

Cicindela discrepans, Walker, Ann. Nat. Hist. (3) ii, 1858, p. 202; Bates, Ann. Nat. Hist. (5) xvii, 1886, p. 69.
Var. *Cicindela lacrymans*, Schaum, Journ. Ent. 1863, p. 57.

A rather large, distinct, and pretty species. Labrum large, black, with the base testaceous, and with very strong teeth palpi testaceous, with the apex dark; head and pronotum metallic coppery, with more or less green and red reflection and the sides cyaneous; head depressed between the eyes, rather strongly so in the female, finely sculptured; pronotum a little longer than broad, subcylindrical, rather shining, distinctly rugose transversely, without setæ at the sides and with the depressions in front and behind not strongly marked; scutellum coppery or in part greenish; elytra long, subparallel-sided, of a velvety reddish olive-green colour, the red prevailing at the apex and shoulders and the green at the sides; each elytron has a longitudinal whitish yellow streak reaching for almost a fourth of its length from the middle of the base, followed by a shorter streak, and behind this two spots, one just behind middle and one before apex; in the male there is also a large spot on the shoulders; the elytra at the extreme apices are rounded in the male, subtruncate in the female; their upper surface is scarcely sculptured, but the green colour appears to be produced by large numbers of very minute green impressions; femora brilliant coppery, knees, tibiæ, and tarsi cyaneous; genæ with a bright green streak; underside of head and abdomen violaceous or cyaneous, of the other parts brilliant copper and green; mesosternum pubescent, all the episterna bare, sides of abdomen almost bare.

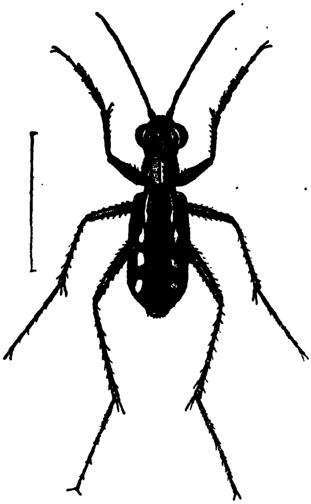
Fig. 168.—*Cicindela discrepans.*

Length 16–20 millim.

CEYLON: Colombo, Nalanda, Kandy.

Var. **lacrymans**, *Schaum.*

This variety differs from the typical form in the much less stout and less bulky shape of the head, pronotum and elytra, the more produced teeth of the longer labrum, the more slender legs, and the smaller and narrower yellow spots on the elytra, the apical one being situated further from the margin.

CEYLON: Kandy, July and August.

167. Cicindela hamiltoniana, *Thoms.*

Cicindela hamiltoniana, Thomson, Arch. Ent. i, 1857, p. 323.
Cicindela flavovittata, Chaudoir, Cat. Coll. 1865, p. 61.

A very distinct and conspicuous species; elongate and parallel-sided. Head and pronotum shining green with the front and sides of the former, and the margins of the latter more or less violaceous; head excavate between the eyes and finely striated; antennæ with the first four joints violaceous; pronotum subcylindrical, longer than broad, without pubescence at the sides, very finely striated, with the central line often hardly visible, very slightly rounded in front and contracted before the base; elytra dull and velvety, finely and not closely sculptured, parallel-sided, green, with an orange stripe on each, extending from the shoulder almost to the apex, slightly sinuate, its apex sometimes curved but usually ending abruptly; these stripes are bounded towards the suture by a black stripe, and towards the margins by bright violaceous and green, this, however, being variable; legs long and slender, femora bright green or coppery, sometimes in part violaceous, tibiæ bright violaceous, tarsi violaceous or cyaneous, trochanters light reddish testaceous; underside green and violaceous, with white pubescence on the sides of the first two segments of the abdomen, the metasternum and the margins of the posterior coxæ; episterna of metasternum bare, with a distinct white tuft at the inner posterior angle. The female is larger and stouter than the male.

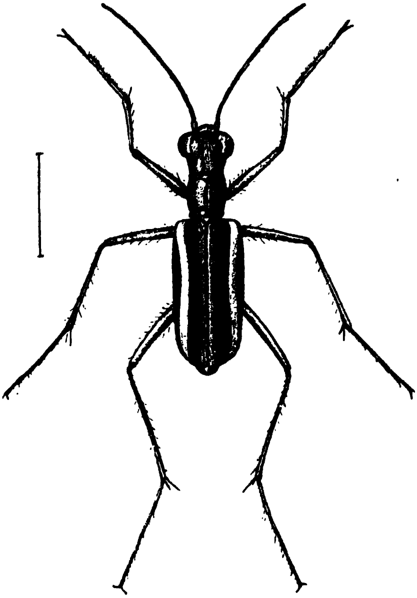

Fig. 169.—*Cicindela hamiltoniana.*

Length 14½–17 millim.

Madras: Travancore, Mysore, Nilgiri Hills (*H. L. Andrewes*).

In August 1906 I received a dozen examples, taken that season, from Mr. Andrewes with the note, "Common on the western side of hills at 2500 to 4500 feet; on roads and open spaces generally." It is usually considered a very scarce insect, and is evidently very local; it appears to be semi-arboreal in its habits.

168. Cicindela andrewesi, *W. Horn.*

Cicindela andrewesi, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 171, pl. 3, fig. 1.

A rather narrow dark species, with three short narrow yellow bands on each of the elytra, one behind the other; labrum dark, with a testaceous spot, clypeus green; head and pronotum black, extremely finely sculptured, eyes only slightly prominent; pronotum of the same breadth as the head, subquadrate, parallel-sided or slightly narrowed to base, without setæ on the upper surface at the sides; elytra dull, smooth, with a narrow yellow oblique band reaching from the shoulder nearly to the middle, a second oblique one behind this, and a small one parallel with the suture before the apex; legs dark; underside mostly violaceous, with the sides of the pro- and meso-sternum bare in the female, scantily pubescent in the male, and the centre of the episterna of the metasternum bare in both sexes; sides of the abdomen scantily pilose.

Length 12½–17 millim.

BOMBAY: North Kanara (*Bell*).

This is a very distinct species; its nearest ally appears to be *C. ceylonensis*, but this is narrower, and as a rule much smaller, and has quite different markings.

169. Cicindela mauritii, *W. Horn.*

Cicindela andrewesi subsp. *mauritii*, W. Horn, Deutsche Ent. Zeitschr. 1908, p. 23.

This species, which is regarded by Dr. Horn as only a subspecies of *C. andrewesi*, differs from the latter in having the head and pronotum shorter and broader, and smaller than in *C. unica*, Fleut., which Dr. Horn also now regards as a subspecies or variety of *C. andrewesi*; the elytra are about as broad as in *C. unica*, but are a little narrowed towards the shoulders; the humeral lunulate spot is shorter than in *C. andrewesi*, the central spot is broader and so appears shorter, and the apical spot is very small; these markings will further distinguish it from *C. unica*.

Length 14–16 millim.

SOUTH-WESTERN INDIA.

Dr. Horn considers this insect as forming a connecting link between *C. andrewesi* and *C. unica*, and in consequence regards all three as races of the one species, *C. andrewesi*; but *C. andrewesi* and *C. unica* may, with reason, be kept distinct, and, if so, it is best to regard *C. mauritii* as distinct also.

170. Cicindela unica, *Fleut.*

Cicindela unica, Fleutiaux, Bull. Soc. Ent. France, 1895, p. ccxlv.
Cicindela flavoguttata, W. Horn, Deutsche Ent. Zeitschr. 1895, p. 359.

A moderate-sized species; green, with the edges of the head and pronotum slightly blue, elytra very dark, almost black towards the apex; labrum dark, subparallel-sided, with seven teeth on the anterior border; mandibles yellow, apex black; head and pronotum finely shagreened, the latter constricted in front and behind, slightly narrowed towards the base; elytra somewhat granulose, furnished with a large yellow oblique patch just behind the middle and not touching the margins; epipleuræ of the elytra yellowish; underside blue, with the sides violet; episterna bare, sides of the metasternum and of the abdomen covered with rather long white hairs; legs violaceous.

Length 14–16 millim.

The only localities given are, "Inde" (*Fleutiaux*) and "Ex occidentali meridionali Indiæ Orientalis Anticæ ora" (*Horn*).

This species belongs to the group with yellow epipleuræ of the elytra (*interrupto-fasciata*, etc.). It is closely allied to *C. mouhoti* var. *goebeli*, W. Horn (=*tritoma*, Gestro, *nec* Schm.-Goeb.) and is remarkable for the length of the tarsi, especially the anterior pair. Dr. Horn compares it with *C. andrewesi*, from which it differs in its more convex form, in having one patch only on the elytra, in the shorter labrum, and in the broader elytra, which are not velvety, but entirely and distinctly sculptured; the head and pronotum are also thicker and the margins of the abdomen are less pubescent,

This is the only species belonging to the old genus *Calochroa* which has only one spot or patch on the elytra, in which it resembles *C. assamensis.*

Since I wrote the above Dr. Horn has very kindly sent me the unique type of *C. flavoguttata* which he regards as identical with Fleutiaux's species; it is, unfortunately, in very poor condition, and most of the pubescence has evidently been rubbed off. The following is a description of it:—

Labrum black, with five distinct teeth in front and the sides bluntly produced (this fact reconciles Fleutiaux' and Horn's (*l. c*) statements; the former says that it is 7-toothed and the latter that it is 5-toothed); head and pronotum black, with very slight metallic reflections at the sides; the former broad and plainly striated between the eyes, very finely rugose behind; pronotum finely sculptured, more strongly so in front of the anterior impression, about as long as broad, with the sides slightly rounded, not setose at the sides; elytra long, subparallel-sided, with the shoulders nearly right angles, narrow in proportion to their length, distinctly shagreened in front, more finely so behind, very dark green, or black-green with a single bright yellow oblique spot on each just behind the middle; legs cyaneous, trochanters dark, tarsi elongate; underside dark, violaceous and cyaneous, sides of metasternum pubescent; the sides of the abdomen are evidently to a certain extent, pubescent, but are much rubbed; episterna and genæ bare.

171. **Cicindela lauræ**, *Gestro.*

Cicindela lauræ, Gestro, Ann. Mus. Genova (2) xiii, 1893, p. 364.

Of a dark greenish cyaneous colour, rather narrow; labrum black with a testaceous spot; pronotum not broader than the base of the head, about as long as broad, slightly narrowed to the base, cylindrical; elytra elongate and parallel-sided, dull greenish black, with the sides bright cyaneous, with three yellow spots on each, the first at the shoulders, elongate, the second about the middle, and the third at the apex; underside cyaneous green, shining, sides of the metasternum and abdomen with white pubescence; legs metallic green and cyaneous.

Length 15–18 millim.

Burma: Karen Hills (*Fea*).

This species is closely allied to *C. assamensis*, from which it may be known by its smaller size, longer pronotum and the elytral spots; the longer and narrower pronotum will separate it from typical *C. mouhoti*. I have not seen the species, but I gather from the description that the episterna of the metasternum are pubescent.

172. **Cicindela tritoma**, *Schm.-Goeb.*

Cicindela tritoma, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 3, pl. i, fig. 3.

A moderate-sized, parallel-sided species; front parts obscurely greenish, very finely rugose and striate, clypeus and front bright green, sides of head and pronotum coppery and green; labrum dark, more or less testaceous; head plainly striated between eyes, very finely rugose behind; pronotum about as long as broad, slightly narrowed behind, very finely sculptured; elytra parallel-sided, colour dark, sometimes obscurely cyaneous, with the sides brighter, with a yellow spot at the shoulders, and joining this a yellow crescent-shaped or wavy longitudinal stripe dilated behind and reaching nearly to the middle, followed by two spots, one just behind the middle and one at the apex; legs metallic, trochanters bright red; underside green or violaceous, with thick white pubescence at the sides, the episterna of the metasternum being, on their upper part at least, pilose; genæ bare.

Length 12 millim.

Burma: Pegu (Ind. Mus.).

173. Cicindela assamensis, *Parry*.

Cicindela assamensis, Parry, Trans. Ent. Soc. Lond. iv, 1845, p. 84; id., op. cit. v, 1848, p. 80, pl. 11, fig. 1.
Calostola assamensis, Motschulsky, Etud. Ent. xi, 1862, p. 22.

A rather large dark species; dull black, with an obscure greenish reflection, which is apparently sometimes absent on the elytra; labrum dark, clypeus and front of head more or less metallic, genæ and sides and underside of head and pronotum bright violaceous and green; head broad, large, flat and striate between the rather prominent eyes, vertex slightly contracted in the male, quite straight and as broad at base as the pronotum in the female, occiput extremely finely sculptured; pronotum transverse, parallel-sided, with long deep depressions in front and behind, finely rugose transversely and without setæ at the sides; elytra subparallel-sided, or slightly and gradually rounded towards the apex, very dull, very finely and not closely shagreened in front, almost smooth behind, with a large yellow spot at the shoulder of each, and a large round one, variable, just behind the middle; apex unicolorous; legs and base of antennæ metallic; underside entirely violaceous and green, metasternum in centre and posterior coxæ with thick white pubescence, episterna of metasternum with a tuft of hairs at the inner posterior corner, the rest bare.

Length 18–20 millim.

SIKKIM: Mungphu, Sukna, Darjiling district; ASSAM: Sylhet, Cachar, Sibsagar, Khasi Hills, Patkai Hills, North Manipur; BURMA: Arakan, etc.; PENANG.

"A very common species at the base of the E. Himalayas; abundant on the banks of sandy streams in jungles, but not, as a rule, entering the jungles." (*Annandale.*)

174. Cicindela mouhoti, *Chaud.*

Cicindela mouhoti, Chaudoir, Cat. Coll. 1865, p. 60.
Var. *Cicindela bramani*, Dokhturoff, Rev. d'Ent. 1882, p. 261.
Var. *Cicindela interrupto-fasciata*, Fleutiaux (*nec* Schm.-Goeb.), Ann. Soc. Ent. France, 1893, p. 494.
Var. *Cicindela goebeli*, W. Horn, Deutsche Ent. Zeitschr. 1895, p. 92.
Var. *Cicindela tritoma*, Gestro (*nec* Schm.-Goeb.), Ann. Mus. Genova, 1889, p. 81; id., op. cit. 1895, p. 361.
Var. *Cicindela anometallescens*, Fleutiaux (*nec* Horn), l. c. p. 492 (*ex parte*).
Var. *Cicindela cariana*, Gestro, op. cit. 1893, p. 363.
Var. *Cicindela anometallescens*, W. Horn, Ent. Nachr. 1893, p. 140.

A moderately large species, with the head and pronotum metallic green, with cyaneous reflections, the sides being brighter, and the elytra dark cyaneous or violaceous blue, with large yellow spots;

labrum large, produced in the middle, with five strong teeth, testaceous, with the anterior margin broadly dark; head broad, flat between the eyes, which are not prominent, striated near the eyes and rugose between the striation, occiput finely sculptured; pronotum somewhat transverse, with the sides very gradually narrowed to the base, strongly impressed in front and behind, with fine rugose sculpture; elytra velvety, very finely sculptured, with a large orange-yellow patch reaching from the shoulders to the scutellum, and continued to about one-third, contracted at each side in the middle, and then again dilated; the sides of the patch do not touch the margins; just behind the middle are two large transversely oval spots, not quite touching the margin and nearly reaching the suture, and before the apex there are two others, very slightly smaller; the apex is rounded and the sutural angle is produced into a short blunt point; legs metallic green and cyaneous, trochanters clear red; underside cyaneous, with the ventral portion green, episterna and genæ bare, sides of anterior segments of abdomen and the metasternum with white pubescence.

Length 17½ millim.

CAMBODIA; COCHIN CHINA; SIAM.

The typical form of the species is extremely rare, and so far as I know, has not occurred within our area; the following varieties, however, are found.

Var. **bramani**, *Dokht.*

Smaller and narrower than the typical *C. mouhoti*; labrum almost entirely dark, and dark testaceous in the middle; head dark green, cyaneous at the sides, excavate and flat between the eyes which are not very prominent, plainly but finely striated, very finely rugose behind; antennæ with the first four joints cyaneous and green, the rest fuscous; pronotum about as long as broad, dark green on the head, with the anterior margin cyaneous, and the sides slightly cyaneous and a little brighter, central line feeble, sculpture rugose and fine; elytra dull velvety black, with a very slight greenish reflection in some lights, sides and suture not brighter than disc, distinctly, but not deeply, punctured, except towards the apex, parallel-sided with the apex gradually rounded, and the sutural angle produced into a distinct spine; at the shoulders there is a distinct triangular orange-yellow patch extending from the margins to the scutellum, and from the posterior end of this proceeds a narrow wavy longitudinal stripe to behind the middle, where it is first contracted and almost broken and then widens out into a large irregular spot; there is also a round spot, a little smaller than this, just before the apex, near the margin; legs coppery green and cyaneous, trochanters dark; underside green and cyaneous, with the sides of the abdomen, the edge of the posterior coxæ, the metasternum, and also the episterna of the mesosternum pubescent; the episterna of the metasternum have a few short hairs at the sides, those of the prosternum and the genæ are bare.

Length 15 millim.

It is doubtful whether this variety has been found in our region; the records from Burma apply to Schmidt-Goebel's species which is quite distinct. There is a specimen in the Calcutta Museum, from Pegu, labelled *interrupto-fasciata*, Schm.-Goeb., which is not Schmidt-Goebel's species but exactly answers to this variety in markings; it has, however, red trochanters and distinct setæ at the sides of the pronotum. The above description is from the type-specimen from Lukhon, Siam, kindly lent me by Dr. Horn; it has also occurred in Cochin China and China proper.

Var. **goebeli**, *W. Horn.*

This variety must not be confused with *C. tritoma*, Schm.-Goeb., the latter being a much smaller and narrower insect, with much more pubescence on the underside; the elytral markings are, indeed, similar, but rather more pronounced. The following description is taken mostly from a typical specimen given by Gestro to Dr. W. Horn:—

A large and robust insect, of about the same size as the typical *C. mouhoti*, but a little narrower; labrum testaceous, broadly margined with black; head large, with a broad flat and only slightly excavate space between the not very prominent eyes, finely striated in front and extremely finely rugose behind, black, metallic at the sides; pronotum black, cyaneous and slightly violaceous at the sides, widest in front and very gradually narrowed to the base, with the depressions marked and slightly metallic; central line very fine, the whole upper surface extremely finely rugose; elytra dull velvety black, without metallic sides, scarcely visibly sculptured, rounded at apex, with the sutural apical angle not produced into a spine; at the shoulders there is a yellow hook-shaped patch, the hook being produced for a short way down the margins, and the other portion forming a broad longitudinal sinuate and irregular stripe, which extends for about one-third of the length of the elytra and is widened at its apex; just behind the middle there is a large nearly round spot, and a round spot of the same size before the apex; legs coppery and cyaneous, trochanters red; underside green-blue and cyaneous, with the coxæ and disc of the metasternum pubescent, and all the rest bare.

Length 17 millim.

Burma: Rangoon, Teinzo, Bhamo.

It is found on paths in the forests.

Var. **cariana,** *Gestro.*

A rather fine and conspicuous insect, very variable in size; head and pronotum brilliant coppery above, green at sides, genæ and underside violaceous; head broad between eyes which are not very prominent; pronotum subquadrate, slightly narrowed to base, with a bright raised callosity at each end of the basal depression, sculpture close and distinct, irregular; scutellum coppery, with greenish centre; elytra parallel-sided, dark, velvety, with a yellow patch at the shoulders, confluent with a waved longitudinal stripe, occupying about a third of the length of each elytron; behind this are two large spots, one at the middle and one before the apex: the anterior stripe is spotted with darker colour; underside violaceous, greenish in parts in the middle, with very scanty pubescence; in the single specimen I have before me (a very fresh one) the episterna of the metasternum are bare and the pubescence of the abdomen is confined to the sides of one segment; legs metallic, trochanters dark.

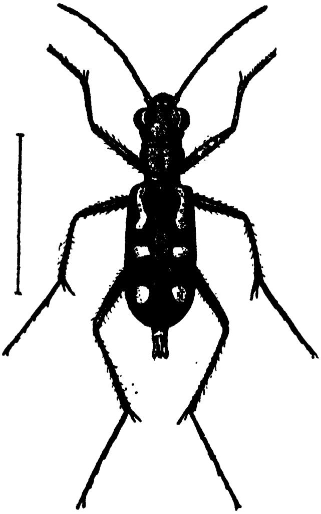

Fig. 170.—*Cicindela mouhoti* var. *cariana.*

Length 11–19 millim.

Burma : Karen Hills ; Tenasserim.

Fea appears to have taken a large series of this insect. It occurs in forest paths, especially in the rainy season, and appears to be remarkable for its long flights. This variety may be distinguished from the var. *goebeli* by the different colour of the pronotum, which is also slightly longer and a little more strongly sculptured, and by the dark trochanters.

Var. **anometallescens,** *W. Horn.*

Labrum testaceous, with dark margins; head broad, black, metallic in front and at sides, distinctly but finely striated between the eyes, which are moderately prominent, very finely sculptured behind; pronotum subquadrate, with the sides very slightly rounded, and the impressions moderate, finely sculptured, central line not strongly marked, black, with bright metallic sides; elytra comparatively narrow, subparallel-sided, rounded at apex with the sutural angle not, or scarcely, produced, dull black, with a small yellow spot on each at the shoulder, another larger, transverse and somewhat irregular, a little behind the middle, and another, nearly round, before the apex; legs metallic, coppery, green and cyaneous, trochanters red; underside bright green in front, darker green behind, with the sides of the front segments of the abdomen, the disc of the metasternum, and the mesosternum pubescent; episterna of the pro- and meta-sternum and the genæ bare.

Length 16 millim.

BURMA: Momeit, Ruby Mines, Maymyo (*H. L. Andrewes*).

Superficially this variety resembles *C. hæmorrhoidalis*, but may at once be known by the colour of the labrum (which is metallic green in the latter species), the narrower thorax, narrower and more parallel-sided elytra, and the dark metallic apical segments of the abdomen; the spots also are different, the humeral one being larger, and the intermediate and apical ones smaller.

The var. *elegantula*, Dokht., of which Dr. Horn has kindly sent me for inspection the unique type, was taken in China; it is very closely allied to the typical *C. mouhoti*, but is smaller and considerably narrower, with the sculpture of the pronotum finer, and the head and pronotum of a much brighter metallic green colour; the markings are similar in character to those of the type-form, but the anterior stripe is longer and much narrower, and the spots are smaller.

175. Cicindela interrupto-fasciata, *Schm.-Goeb.*

Cicindela interrupto-fasciata, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 2, pl. i, fig. 1.
Cicindela flavolineata, Chaudoir, Cat. Coll. 1865, p. 60.
Cicindela ditissima, Bates, Ent. Monthly Mag. ix, 1872, p. 49.

A very distinct species. Head and pronotum bright green, the former with the sides violaceous; labrum testaceous, with dark margins, strongly toothed, rather short, leaving the large sharp mandibles much exposed; antennæ with the first joint coppery, the next three cyaneous, and the following fuscous; palpi testaceous with the apex dark; head long, with a broad flat excavate space between the eyes, which are not prominent, finely striated, and very finely rugose behind; pronotum subquadrate, about as long as the head without the labrum, broadest in front, sides almost straight, very gradually narrowed behind, rather strongly impressed in front and behind, with a shining callosity at each end of the posterior impression, central line obsolete, upper surface very finely rugose, more strongly so in front of the anterior impression; prosternum bright violaceous, the colour, however, not spreading on to the pronotum; sides of pronotum without traces of setæ; elytra rather narrow, subparallel-sided, gently rounded, velvety green, with more or less distinct violaceous margins, dull, with scarcely evident sculpture unless viewed against the light, when they appear to be finely honeycombed; on each there is a transverse orange-yellow patch at the shoulder reaching nearly to scutellum, and from this proceeds a narrow longitudinal stripe reaching to beyond the middle and followed by two slightly broader longitudinal spots, the last one nearly touching the apex, the whole forming an interrupted stripe; extreme margins of elytra violaceous; legs coppery, green and cyaneous, trochanters red; underside green and violaceous, with the sides of the abdomen, the margins of the posterior coxæ, and the sterna pubescent; episterna of meta- and pro-sternum and the genæ bare.

Length 14–15 millim.

BURMA: Teinzo (*Fea*), Ruby Mines (*Doherty*); CAMBODIA; HONG-KONG.

In colour this species bears a resemblance to *C. hamiltoniana*, although in other points it is quite distinct.

The confusion between this species and the variety of *C. mouhoti* which bears the same name has, apparently, been caused by Schmidt-Goebel's figure (*l. c.*), which has the eyes much too prominent, and resembles Fleutiaux' species rather than his own; no two insects, however, in one genus, could well be more distinct.

Var. **flavolineata**, *Chaud.*

This beautiful variety bears a very striking superficial resemblance to *C. hamiltoniana*, the broad yellow lines on the elytra extending from the shoulder to the apex, and being straight and regular, except for a slight wave on the internal side a little before the apex.

Length 15 millim.

BURMA: Maymyo (*H. L. Andrewes*).

176. **Cicindela bicolor**, *F.*

Cicindela bicolor, Fabricius, Sp. Ins. i, 1781, p. 283; Dejean, Sp. Col. i, 1825, p. 43; id., op. cit. v, 1831, p. 209.

Front parts green, finely and rugosely sculptured; head large, forehead broad between the eyes, antennæ metallic green at base, ferruginous towards apex; pronotum about as long as head without the labrum, transverse, subparallel-sided, slightly narrowed to the base, with a few fugitive setæ at the sides; elytra dark greenish cyaneous, or bluish, much more blue than the front parts, dull, with very fine sculpture, almost smooth, and without spots; underside of the front parts violaceous or partly green, of the abdomen dark, with the apex and side margins reddish; legs metallic; episterna of metasternum bare, except for a tuft of white hairs at the inner posterior corner, centre of metasternum, coxæ, and sides of abdomen scantily but plainly pubescent.

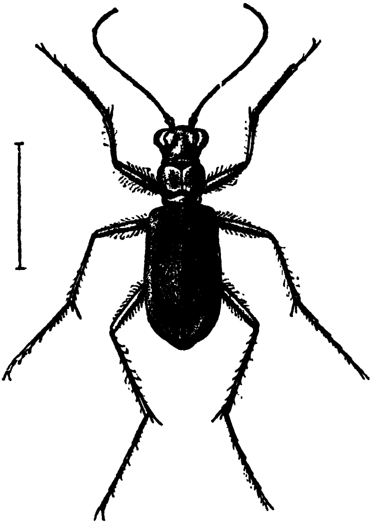

Fig. 171.—*Cicindela bicolor.*

Length 15-17 millim.

Bombay: Poona; Punjab: Simla; Bengal: Calcutta, Asansol, Maldah, Birbhum, Berhampur, Murshidabad, Sahibganj; Assam: Khasi Hills.

On the young rice-fields (*Westermann*).

177. **Cicindela mariæ**, *Gestro.*

Cicindela mariæ, Gestro, Ann. Mus. Genova, 1893, p. 361.

A moderate-sized, parallel-sided, dark species with yellow markings on the elytra; head and pronotum more or less obscurely coppery or greenish with coppery reflections, blue or green at the sides; the former broad and flat between the eyes, which are moderately prominent, distinctly striated, and very finely sculptured behind; labrum testaceous, with a larger or smaller dark margin, the testaceous colour being sometimes reduced to a spot; pronotum subquadrate in the male, slightly transverse and narrower behind in the female, closely sculptured, with scanty pubescence on the sides of the upper surface; elytra black, or black with a greenish tinge, velvety, with a transverse yellow spot at the shoulders, and proceeding from this a large variable sinuate stripe, ceasing before the middle, sometimes confluent with the humeral spot, and sometimes interrupted behind, followed by two large, somewhat variable, spots, one just behind the middle, and one at the apex; legs metallic, trochanters red; underside violaceous or green, abdomen dark, more or less obscurely metallic, sides of abdomen, coxæ, and disc of metasternum with white pubescence, episterna of the metasternum with a few white hairs, prosternum with very scanty hairs in the male, bare in the female; genæ bare.

Length 12–16 millim.

BURMA: North Chin Hills, Tharawaddy, Taung-ngu, Rangoon, Pegu, Karen Hills; TENASSERIM.

178. **Cicindela corbetti,** *W. Horn.*

Cicindela corbetti, W. Horn, Deutsche Ent. Zeitschr. 1899, p. 53.

Allied to *C. hæmorrhoidalis,* but at first sight more like *C. shivah,* from which, however, it is totally distinct. Labrum large, golden coppery, with strong teeth; mandibles large, white, with black tips; head broad, eyes not very prominent, clypeus and front of forehead golden, genæ and underside green, the rest of the surface dull greenish bronze or æneous; antennæ coppery red, fuscous towards apex, palpi testaceous, with dark apex; pronotum and elytra black, dull, the former finely rugose, with the central line and anterior and posterior depressions distinct, transverse, broadest in front and rounded gradually behind; the elytra are almost smooth, with scarcely any apparent sculpture, with a small yellow spot at the shoulders and a large spot of the same colour, roughly semi-crescent-shaped, just about the middle; there is no apical spot, and the apical edge is green; legs metallic, with the trochanters red; underside cyaneous, with the chief part of the front portion brilliantly coloured with metallic crimson, golden green and copper; the pubescence of the underside is very scanty, being confined to the middle of the prosternum and the coxæ.

Length 14–15 millim.

BURMA: Tharawaddy (*Corbett*).

Type in the British Museum (coll. Nevinson); cotype in coll. Horn.

The colouring of the labrum, underside, &c., is very striking and will easily distinguish the species.

179. **Cicindela hæmorrhoidalis,** *Wied.*

Cicindela hæmorrhoidalis, Wiedemann, Zool. Mag. ii, 1, 1823, p. 63.
Cicindela quadrimaculata, Sturm, Cat. 1826, p. 55, pl. 1, fig. 1.
Cicindela flavopunctata, Audouin, Mag. Zool. 1832, p. 18.

A somewhat conspicuous species which may be known by the red apex of the abdomen and the two regular large yellow spots, one at the middle and one before the apex of each elytron, and by the metallic colouring of the labrum and head; the latter is variegated and somewhat variable, but there appear to be always two longitudinal blue or green stripes between the eyes; the genæ are green; labrum large, mandibles powerful, white, with the apical half black; head and pronotum finely rugosely sculptured, dull; antennæ metallic, and fuscous red towards the apex; pronotum dull metallic, transverse, broader in front than behind, gradually narrowed to the base, with a few scanty hairs on each side, and the posterior angles brilliantly metallic; elytra dull black, with the extreme base (including scutellum), and the apical edge, metallic, smooth, and with very little sculpture; at the shoulders, which are well marked, there is a small yellow spot, and four others as above described; these are rather variable, the posterior being sometimes considerably smaller than the anterior, but as a rule they are of much the same size; legs metallic, posterior trochanters red or fuscous red; abdomen dark with the apex broadly red or reddish testaceous in both sexes, and the front parts bright violaceous; the sides of the abdomen and the whole of the metasternum are scantily pubescent, except the episterna of the latter, which are bare, with the exception of a small tuft of hairs at the inner posterior corner.

Length 16–17 millim.

CEYLON; MADRAS: Trivandrum, Nilgiri Hills, Mysore, Karkur; BOMBAY: Kanara; BENGAL: Chota Nagpur, Calcutta, Ganges River; ASSAM; CHINA.

In the Oxford Museum there are two specimens of this species from Madras with smaller spots, labelled *xanthospilota*, Hope, *i. l.*

The specimens from Trivandrum and Karkur (Ghat-Malabar), have the spots smaller and differently shaped.

180. Cicindela fabricii, *W. Horn.*

Cicindela fabricii, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 171.

A rather large and conspicuous species. Labrum large, strongly toothed, shining metallic green or coppery; head dull black, or black-green, or slightly coppery, metallic at the sides, velvety, very finely sculptured, the striation between the eyes being hardly apparent; pronotum varying in colour, coppery or dark, about as long as broad, subcordate, rounded in front and narrowed behind, impressions distinct, side margins with a row of distinct setæ, which are easily rubbed off; elytra rather long, subparallel-sided, dark, velvety, with bright green metallic or coppery colour at the extreme base, sides and apex; at the shoulders is a minute yellow spot, sometimes wanting (this is not a sexual difference), and there are three large yellow spots on each elytron, arranged in a straight longitudinal row on the disc, one usually more oblique than the others at some little distance from the base, a second at the middle, and a third at some distance before the apex; legs metallic, green and cyaneous or violaceous, trochanters dark; underside violaceous in front, cyaneous behind, with the sides of the abdomen (except before apex), and the metasternum pubescent, episterna of the pro- and meta-sternum and the genæ bare.

Length 15–16½ millim.

BOMBAY: North Kanara (*Bell*).

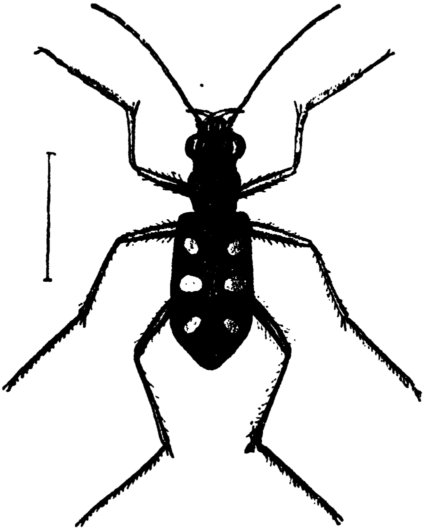

Fig. 172.—*Cicindela fabricii.*

This species, according to Dr. Horn, is allied to *C. aurulenta* and *C. octogramma*. From the former it differs by its bright green labrum and the shorter and broader pronotum, which has the sides rounded, and also by the colour of the elytra; from the latter it may be known by the much finer striation of the head and the longer and narrower pronotum, which has the sides less rounded; the elytra also are much more elongate, with the sides more parallel.

181 **Cicindela octogramma**, *Chaud.*

Cicindela octogramma, Chaudoir, Bull. Soc. Moscou, 1852, p. 4.

Of about the same shape as *C. hæmorrhoidalis*, but smaller. Labrum, clypeus and front of head metallic blue or violaceous; head and pronotum dull metallic, greenish and coppery, with the sides narrowly brighter, sculpture very fine; pronotum transverse, distinctly broader in the middle than the head, narrowed behind, subcordiform, with a few fugitive setæ at the sides; elytra dull, black, or with a very slight greenish reflection, extreme base bright metallic green, upper surface smooth and dull; at the shoulder there is a yellow spot, and on each elytron three others, about coxal cavities. The var. *dejeani*, Hope, has an orange stripe on each elytron. The insect has nothing to do with *C. bicolor*, Fab., with which it has been considered synonymous and with which it may superficially be compared; it might perhaps be placed in the *C. aurofasciata* section, towards which it has distinct affinities.

182. Cicindela cyanea, *F.*

Cicindela cyanea, Fabricius, Mant. i, 1787, p. 155; W. Horn, Deutsche Ent. Zeitschr. 1807, p. 87.
{Var. *Cicindela dejeani*, Hope, Gray's Zool. Miscell. 1831, p. 21.
{Var. *Cicindela obliquevittata*, Fleutiaux, Bull. Soc. Ent. France, 1898, p. 147.

Much larger than *C. bicolor*, with which it has been confused, and of a darker, duller and more uniform colour: upper surface dark cyaneous, with a slight greenish tinge, almost black, with the sides of the labrum, head, pronotum, and elytra shining green, the colour on the latter being duller; the clypeus and front of the head are also green; head broad, eyes not as prominent as in *C. bicolor*; pronotum very slightly narrowed at base; elytra dull, immaculate, with the sculpture very fine, but more distinct than in the allied species; underside more or less violaceous, abdomen without the reddish margins and apex, and with the pubescence much more scanty, and almost wanting, but apparently fugitive.

Length 22–23 millim.

BENGAL: Chota Nagpur, Palkot, Sahibganj.

Var. **dejeani**, *Hope.*

This variety has the elytra ornamented throughout their length with a yellow stripe, starting from the shoulder and becoming widened behind. It has occurred in Chota Nagpur with the type-form, and there is a specimen in the British Museum from Berhampur; it has also been recorded from Murshidabad. It appears to be a very rare insect.

GROUP 18.

Large black species with the head and pronotum very strongly rugose, and the elytra smooth, with conspicuous orange or yellow markings; underside black, smooth and shining, as a rule practically without pubescence. (Length 19–23 mm.)

Key to the Species.

I. Elytra more convex and less parallel-sided, humeral markings crescent-shaped and extended almost or quite to the suture, forming a more or less distinct common cruciform yellow patch .... *aurofasciata*, Dej., p. 407.

II. Elytra less convex and more parallel-sided, humeral markings much abbreviated, irregularly oblong, terminating at some distance from the suture.

i. Form broader and shorter; sides of pronotum more rounded, anterior angles near the apical constriction not strongly produced .... *princeps*, Vig., p. 409.

ii. Form narrower and more elongate; sides of pronotum less rounded, anterior angles near the apical constriction very strongly produced .... *angulicollis*, W. Horn, p. 410.

183. Cicindela aurofasciata, *Dej.*

Cicindela aurofasciata, Dejean, Spec. Col. v, 1831, p. 224.
Cicindela crucigera, Hope, Col. Man. ii, 1838, p. 162, pl. 1, fig. 2.
} Var. *Cicindela lepida*, Gory, Mag. Zool. 1833, p. 96.
} Var. *Cicindela goryi*, Chaudoir, Bull. Soc. Moscou, 1852, p. 3.

A large orange or yellow and black species with the front parts very coarsely sculptured, and the underside with scarcely any pubescence; head and pronotum black, or with an obscure greenish reflection; labrum black, with a yellow or testaceous spot or patch sometimes occupying most of the base; head as long as pronotum, coarsely sculptured, obscurely striate within the eyes, which are not very prominent, antennæ comparatively short and stout; pronotum transverse, strongly impressed in front and behind, widest in front, where it is quite as broad as the head with the eyes, very coarsely and rugosely sculptured, slightly narrowed to the base; scutellum rather large, sharply angled behind; elytra velvety black, smooth, with scarcely visible sculpture, with a broad cross or **X**-shaped orange marking stretching across the front part of the elytra, and more or less variable, according as the orange or black colour predominates, and with a rather broad patch on each at the apex; legs dark; underside black with scanty pubescence, thicker near the coxæ and on the metasternum, very thin on the abdomen; prosternum coarsely sculptured, episterna of metasternum bare,

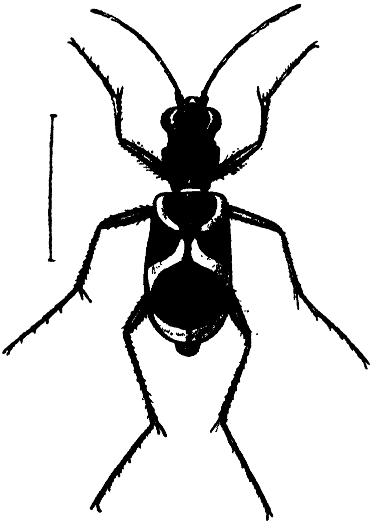

Fig. 174.—*Cicindela aurofasciata.*

shallowly but distinctly sculptured; abdomen shining black; trochanters dark.

Length 20–23 millim.

MADRAS: Travancore, Mysore, Cochin, Nilgiri Hills, Utakamand, 5000–7000 ft., Shimoga, Pondicherry; BOMBAY: Kanara; SIKKIM: Darjiling.

It appears to be common in the Nilgiris. Mr. Andrewes writes as follows:—"April-July, 5000–7000 ft., running and flying in grassy places; once on a jungly road; Droog and Ootacamund Downs." Many remains of *Dorysthenes montanus* were found in places on the Downs where *C. aurofasciata* was very abundant, and perhaps the insects were destroyed by it.

Var. **lepida**, *Gory*.

In this variety the yellow colour of the elytra is much extended, the dark markings of the elytra consisting of a triangular patch at the base, a small triangular patch at each margin behind this, and a large round black spot before the apex; it is described as much narrower and less cylindrical, but this is not the case with the specimens I have seen. *C. aurofasciata* is very variable as regards size and breadth when a large series is examined. Many of these conspicuous insects were described by the old authors from single specimens and hence has arisen much of the confusion.

Length 20–22 millim.

MADRAS: Bangalore, Mysore, Nilgiri Hills, 2500 ft. (*H. L. Andrewes*), Shimoga; BOMBAY: Belgaum (*H. E. Andrewes*), Kanara (*Bell*).

With regard to *C. aurofasciata* and its variety *lepida*, I have received the following particulars from Mr. H. E. Andrewes, to whom they were communicated by Mr. H. L. Andrewes:—"Another interesting point is in regard to *C. aurofasciata*, Dej., and its var. *lepida*, Gory. He says he has never found the type-form in the Nilgiris at a height under 5000 ft., while all the var. *lepida* occur at about 2500 ft. Mr. Bell and I used to get var. *lepida* at Kanara and Belgaum respectively, also at 2500 ft., though we did not get the type-form. The latter would therefore appear to be the high-level and the variety the low-level form."

The lowland form, according to Dr. Horn, is decidedly more agile and takes to flight more easily than the upland form, which sits and runs about in the grass and is quite easily caught by hand; it abounds all over the plateau where there is grass. The lowland form is found all along the road from Gudalu to Tippukadu, the country being teak and bamboo jungle, with a strip of grass covering the road (Annotated List of Beetles in the Indian Museum, i, p. 26).

Var. **seminigra**, nov.

This variety differs from the type-form in having no yellow apical markings, the whole of the elytra from just behind the middle to the apex being black; the sculpture of the elytra moreover, though very fine, is much more evident, and the X formed by the yellow colour is very distinct and lighter than in most specimens of the typical form.

Length 20 millim.

"India."

Type in the British Museum.

Mr. H. E. Andrewes possesses a specimen of an undescribed variety from Poona.

184. Cicindela princeps, *Vig.*

Cicindela princeps, Vigors, Journ. Zool. i, 1825, p. 413, pl. 15, fig. 1.
Cicindela princeps var. *ducalis*, W. Horn, Deutsche Ent. Zeitschr. 1897, p. 294.

Labrum black with a large testaceous patch, mandibles testaceous with the margins, and the apex broadly, black; antennæ dark, stout, maxillary palpi dark, labial palpi yellow, with the apex black; head and pronotum of about equal length, coarsely sculptured, the former irregularly striate inside the eyes, the latter about as long as broad, distinctly narrower and longer in proportion than in the preceding species, constricted in front and behind, with the sides very slightly rounded; elytra subparallel-sided, or slightly widened behind, rather flat, almost smooth, dull and velvety, black, with a large humeral patch, emarginate internally in the centre, and with a broad yellow band at about middle, almost joining the apical yellow marking, which is somewhat broad: the interruption by the black patch is greater in some specimens than in others; suture very narrowly, and extreme margins, black; legs and underside black, the latter with very fugitive pubescence on the coxæ and metasternum (in the type-specimen this is almost or quite rubbed off); episterna of metasternum bare, slightly sculptured.

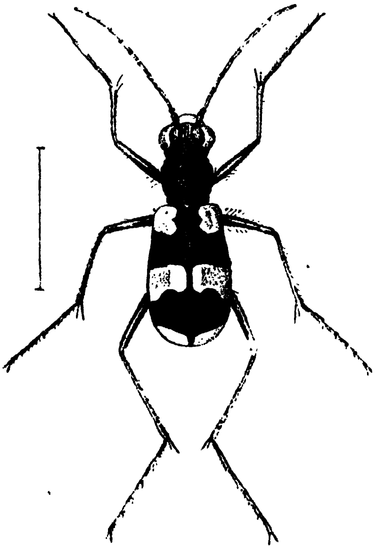

Fig. 175.—*Cicindela princeps.*

Length 19-20 millim.

Madras (?); Central India.

Type in the British Museum.

The above description is taken from Vigors's type.

The species may be known from *C. aurofasciata* by the less coarse punctuation of the head and pronotum, the more parallel-sided and flatter elytra, the different markings, and, as a rule, by the colour of the labial palpi. I have, however, found these last with the base light in one specimen of *C. aurofasciata*, although they are usually dark; so this cannot be regarded as a constant character, and occasionally the humeral patch in the last-named species appears to be abbreviated as in *C. princeps*.

The species is rather closely allied to *C. shivah*, but the latter insect is smaller and more parallel-sided, with the head and pronotum less coarsely sculptured, and the latter more or less plainly angled just before the anterior constriction; the underside, moreover, is much more pubescent, and the yellow markings are much smaller and different.

Var. **ducalis**, *W. Horn.*

According to Dr. Horn this variety differs from the type in having the elytra longer and narrower, and the elytral markings less yellow, the humeral spot being smaller, much narrower and oblique, and the central fascia being placed in the middle and not just behind it and not curved at the suture; the apical linear spot also is much narrower.

Length 16–22 millim.

BENGAL: Chota Nagpur, Palkot.

The shape of the pronotum appears to be very variable in both *C. princeps* and *C. aurofasciata*. Both these species are comparatively sluggish and are easily captured by hand.

185. **Cicindela angulicollis**, *W. Horn.*

Cicindela angulicollis, Horn, Deutsche Ent. Zeitschr. 1900, p. 209.

This species is intermediate between *C. princeps* and *C. shivah*. From the former it differs in its much longer and narrower form, and in having the sides of the pronotum less rounded, straighter in the middle, and with the angles near the apical constriction very prominent and almost right angles; the humeral spot is rather smaller than in the typical *C. princeps*, and the central transverse fascia is placed more towards the apex and is narrower and cut off at some distance before the suture; the posterior lateral angle of the central portion of the metasternum with the coxal margin is thickly pilose; the femora are bright cyaneous. From *C. shivah* it differs in having the labrum furnished with a yellow spot, and the pronotum much narrower and not pilose at the margins; the elytra are a little broader, with the sutural angles forming sharp right angles and not rounded; the markings are somewhat different, the central fascia being placed much more towards the apex, and the apical spot being smaller and narrower and distant from the sutural angle; the underside is much less pubescent.

Length 22 millim.

BENGAL: Dacca; MADRAS: Madura (*Maindron*).

GROUP 19.

Very similar to the preceding group in general appearance, but more parallel-sided and with the underside rather strongly pubescent. The only species contained in this group is rather variable as regards the prevalence of the dark or light colour; it is allied to *C. princeps*, which it closely resembles.

186. Cicindela shivah, *Parry*.

Cicindela shivah, Parry, Trans. Ent. Soc. Lond. 1845, p. 84; id., op. cit. 1848, p. 80, pl. 11, fig. 1.

A comparatively long and narrow dull black species, with the elytra long and parallel-sided, with yellow spots; head broad, with the eyes not very prominent, impressed on front, finely striate between the eyes and then rather strongly rugose; antennæ dark at the base, then ringed with red, then darker red (this is variable); pronotum transverse, deeply impressed in front, central line not strongly marked, angled at the sides in front, and then gradually narrowed to the base, which is very strongly impressed, upper surface strongly rugose; elytra distinctly but shallowly sculptured, smooth and velvety, with a large spot at the shoulders, a large transverse one about the middle, not quite reaching the suture, and broadest at the margins, and a third, crescent-shaped, just at apex: legs and underside black, the latter with the sterna and the sides of the body rather strongly pubescent, the episterna of the metasternum being bare except for a strong tuft of pubescence at the inner posterior angles, and the genæ being slightly pubescent.

Length 17–18 millim.

NEPAL; BOMBAY: Kanara (*Bell*).

Type in the British Museum (coll. Nevinson).

The above description is taken from the type-specimen. In the Oxford Museum there is a specimen labelled *erichsoni*, Hope, which Dr. Horn refers to this species, and in the British Museum is an example labelled *flavomaculata*, Hope, which closely resembles it; the anterior angulation of the pronotum and the sculpture are not so marked as in the type, but the species appears to be somewhat variable.

GROUP 20.

Rather conspicuous species; pronotum with setæ at the sides or on the disc, fugitive and sometimes very scanty; metasternum thickly pubescent, episterna of meta- and pro-sternum nearly bare or very scantily pubescent, genæ bare; elytra with a crescent-shaped white or yellow patch proceeding from the shoulders and continued for a third or half of their length.

Key to the Species.

- **I. Pronotum transverse, about as broad at base as at apex.**
  - **i. Setæ at sides of pronotum short, recumbent; elytra with a spot just behind middle** .... *guttata*, Wied., p. 412.

ii. Setæ at sides of pronotum long, outstanding; elytra with an oblique curved fascia just behind the middle, extending from margin nearly to suture	*calligramma*, Schaum, p. 413.
II. Pronotum subquadrate, distinctly narrower at base than at apex.	
i. Elytra dull green with yellow markings; average size smaller......	*dives*, Gory, p. 413.
ii. Elytra velvety black with white markings; average size larger ..	*ceylonensis*, W. Horn, p. 414.

187. Cicindela guttata, *Wied.*

Cicindela guttata, Wiedemann, Zool. Mag. ii, 1, 1823, p. 63.

A moderate-sized, parallel-sided species, with the head and pronotum rather shining, closely, finely, and asperately sculptured, and the elytra dark green, sometimes almost black-green, with yellow markings at the sides; labrum large, testaceous, with dark margin, distinctly toothed; head plainly striated inside the eyes, which are not strongly prominent; pronotum slightly transverse, widest before the anterior constriction, where it is almost as broad as the head with the eyes, gradually and gently rounded and narrowed behind, with the base about as broad as the apex, distinctly setose at the sides and on the anterior margin; elytra subparallel-sided, velvety green, very finely and not closely but evidently punctured towards base, with a crescent-shaped spot on each at the shoulder, more or less dilated at its posterior extremity, and sometimes extended at the base towards the scutellum, a round spot just behind the middle, not touching the margin, and an oblique broad apical patch ceasing at some little distance from the sutural angle; legs metallic green, coppery and violaceous, trochanters dark; underside mostly violaceous, with the sides of the abdomen and metasternum more or less thickly pubescent, and the sides of the prosternum bare; the episterna of the metasternum, as far as I have seen, are bare in the female and have a few scattered hairs in the male, but they may have been rubbed off in the former case.

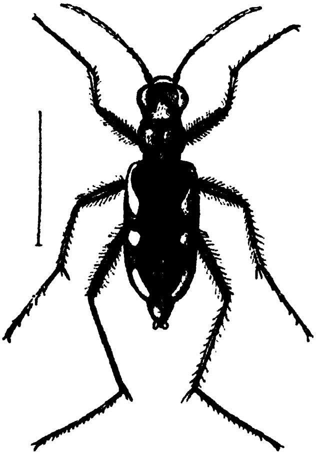

Fig. 176.—*Cicindela guttata.*

Length 13½–16 millim.

Bengal: Chota Nagpur (*Cardon*), Ranchi, Lohardaga; Madras: Shimoga (*Maindron*).

188. Cicindela dives, *Gory*.

Cicindela dives, Gory, Mag. Zool. 1833, p. 97.

A very conspicuous species; head and pronotum greenish with the borders more or less irregularly fiery coppery red, which colour sometimes spreads on to the disc; labrum large, testaceous, narrowly dark in front: head distinctly striated within the eyes, which are moderately prominent, hinder part roughly and closely sculptured, antennæ stout with the first four joints metallic; pronotum about as long as broad, with fugitive setæ at the sides, coarsely and asperately punctured, broadest in front and very gradually narrowed to the base; scutellum red; elytra distinctly widened behind, and with the outline gently sinuate, velvety, with very fine, often obsolete, punctation in front, of a lighter or darker green colour, with a yellow oblique patch at the shoulder, and another patch, almost straight, just behind the middle, both nearly reaching the suture, and a third at the apex touching or almost touching the sutural angle, the elytra thus presenting a banded appearance: the extreme sides and margins are metallic red or violet red; legs coppery-red, trochanters red; underside coppery, abdomen violaceous; the whole of the sides and the genæ are pubescent; the episterna of the metasternum, however, are more scantily furnished with hairs and are sometimes almost bare.

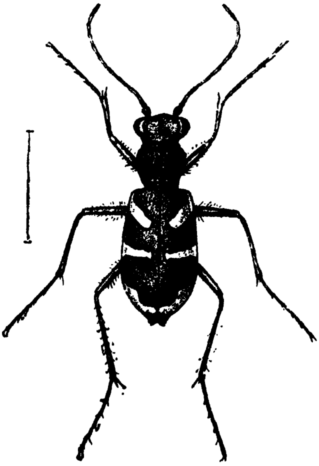

Fig. 177.—*Cicindela dives*.

Length 15–17 millim.

Sikkim; Bengal: Central India: Mhow; Bombay: Kanara, Belgaum; Madras: Mysore.

189. Cicindela calligramma, *Schaum*.

Cicindela calligramma, Schaum, Berlin. Ent. Zeit. 1861, p. 69, pl. 1 B, fig. 1.
Cicindela kraatzi, W. Horn, Deutsche Ent. Zeitschr. 1894, p. 172.

Very like the preceding species superficially, but easily known by its distinctly transverse pronotum, less prominent eyes, more parallel-sided elytra, which are not sinuate at the sides, and dark trochanters; the head and pronotum are greener and less coppery, and the antennæ have the last seven joints red in the female; the elytral markings are different, the humeral crescent being much extended, proceeding from the scutellum almost to the centre of the elytra, and being often confluent with the large oblique variable central patch; the apical patch, too, is broader; the ground-colour is brighter green and the extreme margins only are metallic; occasionally, however, brownish specimens occur; legs metallic, more or less coppery red, trochanters dark; underside greenish, cyaneous and violaceous, sides of the abdomen thickly pubescent, episterna of prosternum and metasternum, and the genæ scantily pubescent, the episterna of the metasternum being often almost or quite bare.

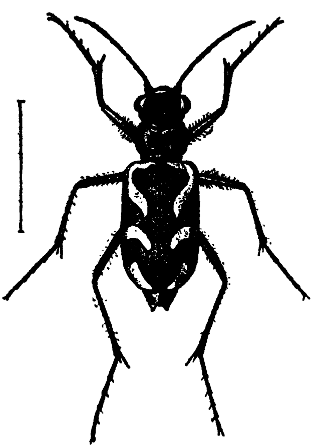
Fig. 178.—*Cicindela calligramma.*

Length 15–16 millim.

Ceylon; Madras: Trivandrum, Shimoga; Bombay: Kanara.

Var. **confluens**, nov.

The shape of the elytral markings is very variable, especially of the basal and central ones; the light colour in some cases is more or less confluent and occupies the greater part of the elytra (var. *signat. confluent.*, Chaudoir, Cat. Coll. 1865, p. 38); it occurs, apparently, with the type-form.

Type in the Oxford Museum.

190. **Cicindela ceylonensis**, *W. Horn.*

Cicindela ceylonensis, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 87; id., op. cit. 1894, pl. iii, fig. 3.

Cicindela ceylonica, Fleutiaux (in error), Cat. Cic. 1892, p. 117.

Cicindela ceylonensis var. *diversa*, W. Horn, Spol. Zeyl. ii, 1904, pl. i, fig. 19.

A black velvety species, with white elytral markings, apparently very variable in size; labrum large, white, broadly bordered with black in front, with strong teeth; head long, with the eyes not very prominent, striate within the eyes, and finely sculptured behind; antennæ stout, with the first four joints shining black; pronotum shorter than the head with the labrum, widest in front, where it is almost as broad as the head with the eyes, gradually and slightly narrowed in almost a straight line to the base; there are a few fugitive setæ on the disc; at each basal angle behind the depression is a small raised shining callosity; elytra subparallel-sided, with the sides slightly rounded, velvety black, hardly perceptibly sculptured, with a white linear patch at the shoulders, sometimes dilated at the base and touching the scutellum, an oblique linear patch sloping from right to left at middle, and a longitudinal or broad comma-shaped spot before the apex; legs dark, more or less cyaneous, trochanters black; underside violaceous, with the sides of the abdomen, except apical segments, and of the metasternum proper, thickly pubescent; episterna of the prosternum bare, of the metasternum almost bare, with a few setæ at the sides.

Length 15–20 millim.

Ceylon: Trincomali, Wellawaya (*E. E. Green*).

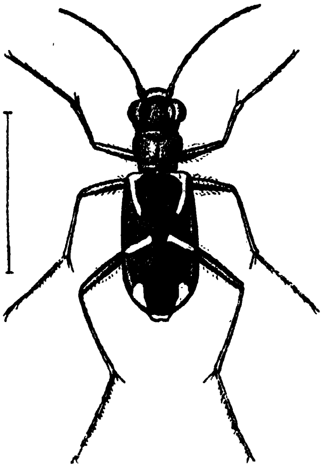

Fig. 179.—*Cicindela ceylonensis* var. *diversa*.

Var. **diversa**, *W. Horn*.

This variety has the central linear patch on the elytra broader and less oblique and the hinder patch larger and more produced towards the centre: the anterior linear patch is also more curved. It apparently occurs with the type-form. Only the figure is given by Dr. Horn and a reference without description on page 4, no. 31, *l. c.*

Ceylon: Damboolla.

Group 21.

Pronotum with the sides furnished with very distinct setæ, which, in fresh specimens, spread more or less over the disc; genæ more or less strongly pubescent *; sides of underside thickly clothed with pubescence, which is villose or tomentose; episterna of metasternum nearly covered, or partly bare. Three species are included in this section, two with the elytra black with a number of conspicuous white spots and markings, and the other with the elytra dark with yellowish linear patches.

Key to the Species.

I. Elytra black with white markings: pubescence clear white, thick and tomentose.
  i. Length 15½–17 mm.; pronotum quadrate, broader; elytral spots more regular and more numerous; episterna of metasternum abruptly bare on their inner side .... *vigintiguttata*, Herbst, p. 416.

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* Except in the quite recently described *C. lefroyi*, W. Horn, which is apparently closely allied to *C. vittigera* and is found in company with it; it should perhaps be referred to another section.

ii. Length 12–13 mm.; pronotum longer than broad, narrower; elytral spots less regular and less numerous; episterna of metasternum almost covered with pubescence .... *multiguttata*, Dej., p. 417.

II. Elytra obscure dark green or almost black, with linear, straight or slightly curved yellow or yellowish white markings.

i. Genæ pubescent; middle band of the elytra longer, curved ...... *vittigera*, Dej., p. 417.

ii. Genæ bare; middle band of the elytra shortened and straighter.. *lefroyi*, W. Horn, p. 418.

191. Cicindela vigintiguttata, *Hbst.*

Cicindela vigintiguttata, Herbst, Käfer, x, 1806, p. 174, pl. 179, fig. 9; Dejean, Spec. Col. i, 1825, p. 108.

A moderate-sized dark species, usually with ten white markings on each elytron; labrum short, truncate, whitish testaceous, mandibles much exposed, white, with the tips broadly black; head and pronotum dark metallic, with two stripes between the eyes, and the sides bright blue and green, sometimes more or less coppery; head very finely sculptured, with a few slight striæ near the eyes; pronotum subquadrate, with the sides nearly straight, or very slightly rounded, plainly setose at the sides; elytra subparallel-sided in the male, slightly widened behind in the female, black, black-green, or slightly cyaneous, each with a small white humeral crescent, a longitudinal patch near the scutellum, an apical spot, and seven other spots, three near the suture, two on the disc, and two near the margins; these vary in size and shape, but appear not to be confluent; legs long, metallic green and violaceous, trochanters pitchy; underside green and violaceous, almost completely covered, except just in the middle, with thick whitish tomentose pubescence; genæ thickly pubescent.

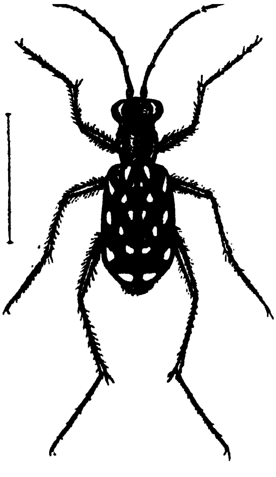

Fig. 180.—*Cicindela vigintiguttata*.

Length 15½–16 millim.

Bengal: Berhampur, Dacca, Murshidabad, Rajmahal, Birbhum, Damukdia, Sara Ghat; Sikkim: Kurseong, Mungphu, Pankabari; Bhutan.

On young rice-fields (*Westermann*); Dr. Annandale records the species from a flooded millet field at the edge of the River Ganges.

192. Cicindela multiguttata, *Dej.*

Cicindela multiguttata, Dejean, Spec. Col. i, p. 109.

Smaller than the preceding, which it much resembles in general appearance; it may be easily known by the longer labrum, the smaller head, the much narrower space between the more prominent eyes, and the longer and distinctly narrower pronotum, which is rather longer than broad; the white markings on the elytra are different, the lunule at the shoulder being larger, and the hinder markings more or less confluent; of these there are five or six in all on each, besides the humeral patch; the apical patch is crescent-shaped and dilated at its upper extremity; the trochanters are red; the underside is thickly pubescent at the sides, as in the preceding species, the genæ being comparatively scantily but distinctly pubescent.

Length 12–13 millim.

Bengal: Calcutta, Sara Ghat, Asansol; Nepal; Assam: Patkai Hills.

193. Cicindela vittigera, *Dej.*

Cicindela vittigera, Dejean, Spec. Col. i, p. 107.

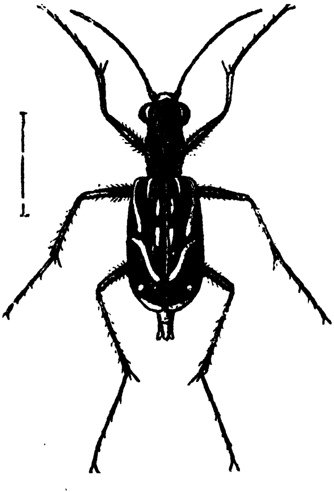

Fig. 181.—*Cicindela vittigera.*

Labrum rather large, testaceous; head and pronotum dark, coppery and greenish, very finely sculptured, with very fine striæ just within the eyes, which are not very prominent; pronotum subquadrate, a little longer than broad, with the sides almost straight, margins with distinct setæ; elytra somewhat dilated behind, dull, velvety, scarcely perceptibly punctured, obscure dark green, with a long yellow linear patch on each extending from the shoulder to the middle, and a long patch of about the same length, but more curved, extending from the middle nearly to the apex; besides these there is a short linear patch close to the scutellum, two more of the same character on the front half near the suture, and a spot before the apex, which is sometimes joined to the extremity of the yellow marginal apical marking; legs and underside metallic, cyaneous or green, the latter with the sides of the abdomen, and the sterna, thickly pubescent, the episterna of the meta- and prosternum, and also the genæ, being furnished with scanty hairs, and sometimes almost bare.

Length 12–13 millim.

Bengal: Berhampur, Maldah, Damukdia, Goalbathan, Dacca, Calcutta.

194. Cicindela lefroyi, *W. Horn.*

Cicindela lefroyi, W. Horn, Records of the Indian Museum, vol. ii, p. 409 (1908).

Closely allied to *C. vittigera*, from which it differs in having the cheeks without pubescence, the pronotum broader, and the middle band of the elytra shortened in front and behind and straighter: the elytra are less distinctly serrulate behind, and the apex of the suture of the elytra in the male is only slightly, in the female moderately, retracted; the fourth joint of the antennæ in the male has two short setæ at some distance from one another, but is not furnished with a pencil of hairs. The forehead and the pronotum are coppery, and the elytra are velvety black, except at the margins, with fourteen larger or smaller white spots and patches; the episterna of the prosternum are densely clothed towards the coxæ with white bristles, but elsewhere are bare; the margins of the abdomen and of the metasternum, the episterna of the metasternum, except in the centre, and the epimera and episterna of the mesosternum (except at the sides) are also clothed with white bristles.

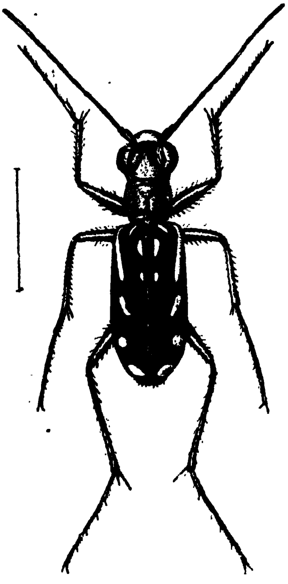

Fig. 182.—*Cicindela lefroyi.*

Length 13½–16 millim.

Bengal: Pusa, Chapra (*H. M. Lefroy*).

Group 22.

In this group the pronotum is furnished with distinct setæ at the sides, but they do not encroach upon the disc; the genæ in quite fresh specimens are distinctly setose at the base, but the setæ are very fugitive and are very often entirely wanting; the sides of the abdomen, except at the apex, are clothed with thick pubescence, and the episterna are mostly bare.

I. Elytra broader, with the sculpture very fine, scarcely traceable; size considerably larger (10–15 mm.).
  - i. Elytra more parallel-sided, with the white markings conspicuous, the lateral ones being broad and almost or quite continuous .... *striolata*, Ill., p. 419.
  - ii. Elytra more rounded at the sides, with the markings broken and much reduced.
    - 1. Pronotum distinctly sculptured, with the sides more rounded; length 10–13 mm. *striolata* var. *lineifrons*, Chaud., p. 421.
    - 2. Pronotum very finely sculptured, with the sides almost straight; length 15 mm. .... *striolata* var. *parvimaculata*, nov., p. 421.

II. Elytra narrower, with the sculpture more evident; size much smaller (8 mm.). .... *atkinsoni*, Gestro, p. 422.

C. striolata bears a strong relation to *C. oberthuri* and *C. intermedia*, and this group therefore has strong affinities to group 12.

195. Cicindela striolata, *Ill.*

Cicindela striolata, Illiger, Wiegm. Arch. i, 1800, p. 114.
Cicindela semivittata, Fabricius, Syst. El. 1801, p. 237; Schmidt-Goebel, Faun. Col. Birm. 1846, p. 3, pl. i, fig. 4.
Cicindela vigorsi, Dejean, Spec. Col. v, 1831, p. 223.
Cicindela lineifrons, Chaudoir, Cat. Col. 1865, p. 62.

A very widely spread species that varies very considerably as regards size and markings; head and pronotum with a more or less distinct coppery reflection, with the sides bright green and coppery, and with two short blue lines (not always evident) between the eyes; labrum large, testaceous, with or without dark anterior margin; head rather plainly striated between the eyes, which are rather strongly prominent, very finely sculptured behind; pronotum about as long as broad, with the sides more or less rounded, with distinct, but short and scanty, setæ at the sides, very finely sculptured, constricted in front and behind: elytra long, parallel-sided, with very variable whitish or yellowish markings, consisting, as a rule, of a long white stripe extending from the shoulders nearly to the apex and parallel with the margins, and inside it several small spots and patches; the long stripe, however, is often broken and irregular, but it can usually be traced; the smaller patches are very variable and in a long series range from being very conspicuous to being almost entirely absent; the ground-colour of the elytra is velvety black, and there is hardly a trace of sculpture; the shoulders are well marked; legs and underside metallic, coppery, green, and cyaneous; sides of abdomen, except towards apex, pubescent; episterna of metasternum and prosternum almost bare; genæ, as a rule, quite bare, occasionally with a few very scanty hairs.

Length 10–15 millim

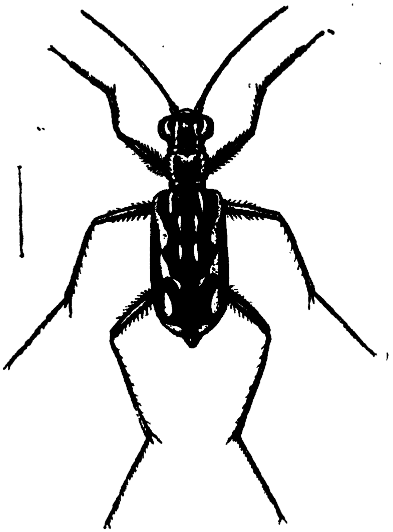

Fig. 183.—*Cicindela striolata.*

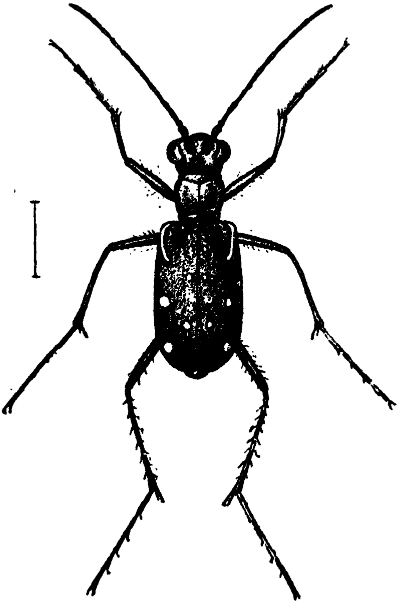

Fig. 184.—*Cicindela striolata* var. *lineifrons.*

Madras: Trivandrum, Mahé, Nilgiri Hills; Bombay: Kanara; Bengal: Chota Nagpur, Maldah, Calcutta; Sikkim: Mungphu; Assam: Khasi Hills; Burma: Teinzo, Tharawaddy, Pegu; Tenasserim; Indo-China; Sumatra; Java; Borneo; Celebes; Philippine Is.; China; Formosa.

Occasionally examples of this species superficially resemble *C. multiguttata*; these may be distinguished by the shape of the pronotum, which is plainly constricted behind in *C. striolata*.

Var. **lineifrons**, *Chaud.*

This variety has the head and pronotum, as a rule, more distinctly and brightly coppery, and the elytra broader and more rounded at the sides, the markings are reduced, and there is no trace of the longitudinal stripe extending from the shoulder almost to the apex; this is entirely broken up into a very narrow humeral crescent and several small spots on each elytron; the pubescence of the underside is much the same as in the type-form, but it appears to be easily rubbed off and so is very deceptive.

Length 10–13 millim.

Madras: Nilgiri Hills (*H. L. Andrewes*); Bombay: Kanara (*Bell*); Burma: North Chin Hills, Karen Hills, Teinzo (*Fea*), Tharawaddy (*Corbett*), Pegu; Tenasserim; Perak; Cambodia; Tonkin.

Var. **parvimaculata**, nov.

Closely allied to var. *lineifrons*, but larger, with the pronotum more quadrate, less rounded at the sides and much more finely sculptured, almost smooth; the sides are very slightly and gradually narrowed to the base; elytra with the markings reduced to a few small or very small spots and blotches on each; the pubescence of the underside is much as in the type-form.

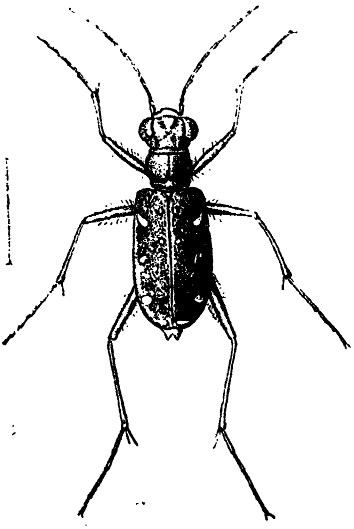

Fig. 185.—*Cicindela striolata* var. *parvimaculata*.

Length 15 millim.

Described from one female specimen, labelled "Dhargeely," in the British Museum, probably in error for Darjiling.

Dr. Horn kindly examined this insect and labelled it as a new species; very probably he may be right, but it is so closely allied to the var. *lineifrons* that I would rather not describe it as specifically distinct on a single example.

196. Cicindela atkinsoni, *Gestro.*

Cicindela atkinsoni, Gestro, Ann. Mus. Genova, 1893, p. 357.

This species appears to be closely allied to the var. *lineifrons* of *C. striolata*, but is much smaller, with larger labrum, and differently arranged elytral spots, which are more numerous; the elytra, moreover, are a little narrower, and the sculpture more evident; the pronotum is much the same both as regards form and sculpture; the labrum is white, large, and arched, with a small central tooth in the middle; head coppery, shining, with the forehead furnished with two green lines, base of antennæ bronze green; pronotum coppery, with the sides narrowly greenish-cyaneous; elytra blackish bronze, narrowly and obsoletely edged with bronze-green, with the humeral crescent entire, elongate and broad, very slightly curved inwards at the apex, and the apical crescent interrupted; besides these there is a central oval spot near the side margins, and six other spots on each elytron, the first in the centre of the base, four before and about the middle, and the sixth behind; all these lunules and spots are white surrounded with black; legs metallic: underside coppery in front, abdomen cyaneous, sides of the latter and the episterna pilose.

Length 8 millim.

BURMA: Karen Hills (*Fea*), Rangoon (in the collection of Mr. H. E. Andrewes).

Type in the Genoa Museum.

GROUP 23.

This group contains a single species, *C. fuliginosa*. It is closely allied to the two preceding groups, but differs from the former in having the genæ without setæ; and from the latter in the last-mentioned point (which does not afford a good character in this case as the setæ in *C. striolata* are so scanty and fugitive), and also in the fact that the disc of the pronotum is more or less setose. The species is small, and may at once be known from its allies by having the whole of the margins of the elytra from scutellum to apex continuously bordered with white.

197. Cicindela fuliginosa, *Dej.*

Cicindela fuliginosa, Dejean, Spec. Col. ii, 1826, p. 415; Schmidt-Goebel, Faun. Col. Birm. 1846, p. 5, pl. i, fig. 6.

Allied to *C. striolata* which it much resembles at first sight, but easily known by having the whole of the margins of the elytra whitish testaceous, and by the less rounded sides and coarser sculpture of the pronotum, which is much less constricted at the base; labrum large, more or less rounded, testaceous, with the anterior margin narrowly dark; head and pronotum dark, with coppery and violaceous reflections; the former excavate and strongly striate between the eyes, very finely sculptured behind; pronotum subquadrate, with the sides almost straight, very slightly narrowed behind, moderately and strongly asperately sculptured, not constricted behind, impressions not deep blue or violaceous, upper surface setose at the sides and with scattered setæ on the disc (in fresh specimens); elytra rather long in proportion to their breadth, subparallel-sided, very slightly, but perceptibly, sinuate at the sides, dark, velvety, with the margins from scutellum to apex white, and emitting at intervals short blunt or dentate processes, three on each side, as shown in the figure; there are also variable spots on each side of the suture, and the central dentate marking is sometimes recurved and meets one of these, forming the inverted V-shaped mark so characteristic in the *undulata*-group; legs metallic, green blue or coppery, trochanters clear red; underside metallic, sides of abdomen thickly pubescent, episterna rather scantily pubescent, genæ bare.

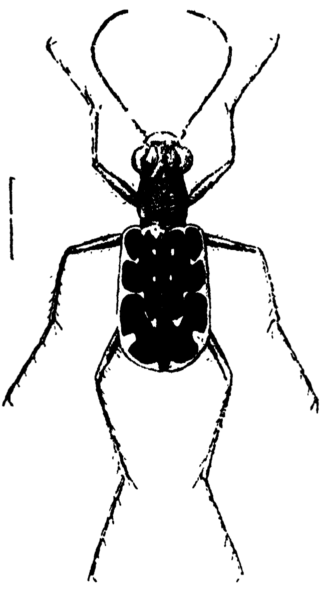
Fig. 186.—*Cicindela fuliginosa.*

Length 9–10 millim.

CEYLON; BURMA: Teinzo, Bhamo, Pegu; MALAY STATES; CAMBODIA; COCHIN CHINA; JAVA; BORNEO.

GROUP 24.

Light-coloured species with dark antler-like markings (length 10-12½ mm.); sides and more or less of the disc of the pronotum setose; underside thickly pubescent, episterna of metasternum more scantily pubescent in the middle, genæ bare, basal joints of antennæ setose; posterior margin of the eyes with a tuft of setæ.

I. Elytral markings making three connections with the sutural marking .... *cancellata*, Dej., p. 424.
II. Elytral markings making only two connections with the sutural marking ...... *histrio*, Tsch., p. 425.

198. Cicindela cancellata, *Dej.*

Cicindela cancellata, Dejean, Spec. Col. i, 1825, p. 116; Schmidt-Goebel, Faun. Col. Birm. 1846, p. 5, pl. i, fig. 4.
Var. *Cicindela candei*, Chevrolat, Rev. Zool. 1845, p. 96.

Head and pronotum coppery with various metallic reflections, and with the sides green or bluish, the former shining, excavate and strongly striated between the eyes, which are very prominent; hinder part of vertex very finely sculptured; labrum large, white, produced in front; antennæ with the base metallic and the rest reddish, the first joint furnished with a few white hairs; there are also a few white setæ at the inner posterior angle of the eyes; pronotum dull, finely sculptured, subquadrate, with the sides almost straight and with scanty hairs on the margins; elytra subparallel-sided, with the sides gently rounded, strongly impressed between the suture and shoulders, whitish testaceous, with large dark or dark green branching antler-like markings connected with the dark suture and not reaching the margins; as the species is figured, it is not necessary to describe these in detail, further than to say that they make three connections with the suture; the extreme edge of the elytra is dark; there is no evident sculpture but occasionally there are a few scattered dark punctures before the apex; legs and trochanters metallic; underside violaceous, with the front parts coppery, sides of the abdomen and the sterna densely pubescent, genæ bare.

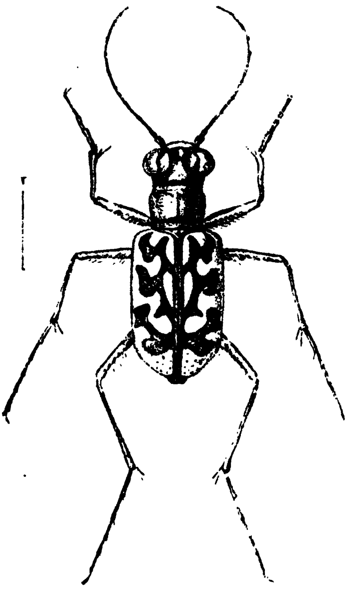

Fig. 187.—*Cicindela cancellata.*

Length 10-11 millim.

Madras: Tuticorin, Travancore, Trichinopoli, Mahé, Mysore; Bombay; Sind: Karachi; Bengal: Berhampur, Murshidabad, Asansol, Kunbir, Nowatoli, Orissa; Sikkim: Kurseong, Sukna; Burma: Tharawaddy, North Chin Hills, Arakan; Cochin China; Java.

The species closely resembles *C. catena* in general appearance and is often mixed with it in collections.

The var. *candei*, Chevr., which only differs in having the pattern of the markings broader, so that the elytra appear darker, has been found in Pondicherry, Mahé Island, Trichinopoli and Hong-Kong.

199. Cicindela histrio, *Tsch.*

Cicindela (Chætostyla) histrio, Tschitschérine, Horæ Soc. Ent. Ross. xxxvi, 1903, p. 16.

This species very closely resembles *C. cancellata* and *C. catena*, but may be at once known from both by the fact that the dark markings of the elytra make only two connections with the suture, and do not join it before the middle, and by the red trochanters, and also by the extreme border of the elytra, which is dark behind the shoulder and then reddish or reddish testaceous, in both sexes; in the female the apical portion of this border is violaceous; the juxta-orbital striation is also stronger than in either of the other two species; the sides of the brilliantly metallic abdomen and sternum are for the most part thickly tomentose, but the sides of the episterna of the pro- and meso-sternum are abruptly bare; the genæ also are bare; the episterna of the metasternum are thickly tomentose; the last ventral segment or segments are sometimes red; there is a thick tuft of hairs at the posterior inner angle of the eyes, and the first joint of the antennæ is setose; the pronotum is subquadrate, closely but distinctly sculptured, dull, with the margins thickly setose, and with setæ on the centre of the disc; legs long, metallic, trochanters clear red.

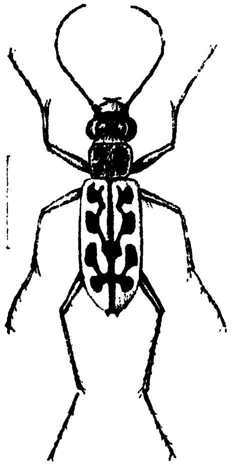

Fig. 188.—*Cicindela histrio.*

Length 10½–12½ millim.

Sind: Karachi, Manora (*Bell*); Persia: Khorassan, Seistan, Bampur.

The species appears to have a very wide range and will probably be found in many other localities; it is so like the common *C. catena* that it is very likely to be passed over.

Group 25.

Closely allied to the preceding, but with the genæ distinctly and rather strongly pubescent.

I. Form broader; pronotum broad, transverse; elytra with the light colour prevailing .... *catena*, F., p. 426.
II. Form narrower; pronotum narrow, longer than broad; elytra with the dark colour prevailing .... *striatifrons*, Chaud., [p. 426.

200. **Cicindela catena**, *F.*

Cicindela catena, Fabricius, Syst. Ent. 1775, p. 226; Olivier, Ent. ii, 1790, p. 20, pl. i, fig. 12; Dejean, Spec. Col. i, p. 117.
Cicindela capensis, Herbst, Fuessly, Arch. Ins. 1784, p. 149, pl. 27, fig. 14.

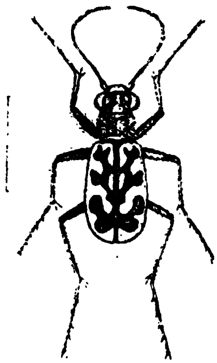

Fig. 189.—*Cicindela catena.*

Very like *C. cancellata*, from which it may be at once known by the densely pilose genæ, these being bare and shining in the last-named species; the episterna of the prosternum are not bare at the sides; the eyes are less prominent, and the pronotum is slightly shorter, with the sides more rounded, and the punctation evidently stronger; the pubescence, moreover, is much more marked; there is a small but distinct tuft of setæ at the posterior inner angle of the eyes, as in the two preceding species, and the first joint of the antennæ is setose; the elytra are a little shorter, broader and less parallel-sided, and the front set of markings are therefore evidently shorter; in character they resemble those of *C. cancellata*; the episterna of the metasternum are in part bare, with the upper portion and the margin thickly pubescent; the legs are metallic green and coppery, and the underside is violaceous, except the episterna which are of a brilliant fiery copper colour.

Length 10–12 millim.

CEYLON: Colombo, Matale, Kandy; MADRAS: Travancore, Chatrapur, Mysore: BENGAL: Calcutta, Chota Nagpur; SIKKIM: Darjiling; BURMA: Teinzo.

Widely distributed, and apparently not uncommon.

201. **Cicindela striatifrons**, *Chaud.*

Cicindela striatifrons, Chaudoir, Bull. Soc. Moscou, 1852, p. 12.

Closely allied to *C. catena* and *C. cancellata*, but much narrower and more cylindrical, and with the space between the eyes narrower and strongly striated; the genæ are pubescent as in *C. catena*, and the sides of the pronotum and mesosternum are bare as in *C. cancellata*; the episterna of the metasternum are bare in the centre; pronotum parallel-sided, rather longer than broad, dull, finely sculptured, with scanty setæ at the sides and on the disc; elytra narrow, subparallel-sided, with the dark colour prevailing (a character which gives the insect a different superficial appearance from its allies); the markings, however, are of the same character as in *C. catena*, only exaggerated, and they touch the suture at four places, and the margins at two; or, taking the ground colour as dark, the light markings may be described as follows: a large lunule at the shoulders, touching a triangular spot near scutellum, curved and widened behind, a broad inverted V-shaped patch at the middle, and a lunule at the apex, dilated at both ends; there are also two small spots in front near the suture. It will be noticed that the patterns of all these species bear a close analogy to that of the *undulata* group; legs and underside metallic green, violaceous and coppery, trochanters pitchy red.

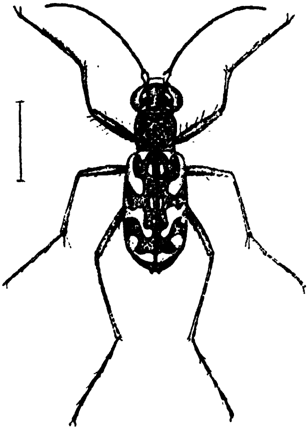

Fig. 190.—*Cicindela striatifrons.*

Length 10 millim.

BENGAL: Murshidabad, Berhampur (*Atkinson*); BOMBAY: Kanara (*Bell*).

Mr. Bell says, "By the side of rivers, on sand, in June; very shy and hard to catch; retiring into the muddy grass at night, in jungle country."

GROUP 26.

Head and pronotum entirely pubescent: underside, except in the centre, entirely tomentose; elytra whitish testaceous, with linear dark markings. This group contains one very pretty and distinct species.

202. **Cicindela albina,** *Wied.*

Cicindela albina, Wiedemann, Zool. Mag. i, 3, 1819, p. 169.
Cicindela albida, Dejean, Spec. Col. i, 1825, p. 125.

Labrum testaceous, truncate or slightly rounded, mandibles and palpi testaceous, with the apex only dark; head and pronotum coppery, finely sculptured, covered with thick white pubescence, the former not, or very finely, striate within the eyes, which have only a narrow space between them in front; pronotum subquadrate, with the sides very slightly rounded, finely sculptured; elytra with the sides gently rounded, dull white, with dark linear markings, which do not touch either the base, apex or margins, and take the form of a line, running parallel with the suture (which is narrowly dark), from which spring three more or less irregular oblique stripes, parallel with one another, and starting one from the apex, one from behind the middle and the other from before the middle; the posterior one is notched behind and often it is separated altogether from the longitudinal stripe, with the dilated end of which it forms a separate marking; the extreme margins are coppery; legs metallic with white pubescence, femora thickly pubescent, trochanters clear red; underside in fresh specimens, including the genæ, entirely clothed (except just under the head and a small patch in the centre) with thick white tomentose pubescence, which completely hides the metallic colour; the pubescence is often rubbed on the centre of the abdomen and other parts, but in fresh specimens is very striking.

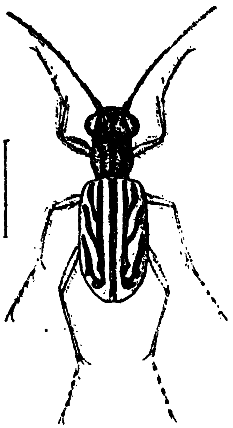
Fig. 191.—*Cicindela albina.*

Length 13–16 millim.

Bengal: Chota Nagpur, Asansol, Orissa; Sikkim: Darjiling.

On sand dunes in Orissa, not on the sea-shore (*Annandale*).

Group 27.

Very distinct insects, with the elytra ovate; disc of the pronotum and the genæ bare and shining; prosternum and episterna of the metasternum with very long white pubescence, projecting at the sides of the former; abdomen bare and shining.

I. Size much larger (11–12 mm.); elytra gradually and rather strongly narrowed from behind middle to base, broadest behind middle .... *ornata*, Fleut., p. 428.

II. Size much smaller (8 mm.); elytra scarcely narrowed in front, broadest at about the middle .... *copulata*, Schm.-Goeb., [p. 429.

203. Cicindela ornata, *Fleut.*

Cicindela ornata, Fleutiaux, Bull. Soc. Ent. France, 1878, p. 146; Maindron, Ann. Soc. Ent. France, 1899, p. 383.

Much larger than the succeeding species, from which it is very distinct. Labrum large, clear white; head and pronotum brilliant coppery red, the former somewhat excavate and finely striated between the eyes, the latter subquadrate, rather longer than broad, very finely sculptured, with a thick frill of long setæ projecting from the sides of the prosternum, which will at once distinguish the species; there are also short setæ at the apical margin; elytra subovate, widened behind, very finely and closely, but quite perceptibly, punctured, with the suture broadly coppery until behind the middle, where the colour contracts for a short distance and from its apex proceeds an oblique hatchet-shaped marking; on the front of the disc is a linear coppery marking, reflexed at its apex towards the margins; the extreme margins are white, concolorous with the elytra; legs long, metallic, trochanters metallic; underside much as in the succeeding species, with all the episterna pubescent and the genæ bare.

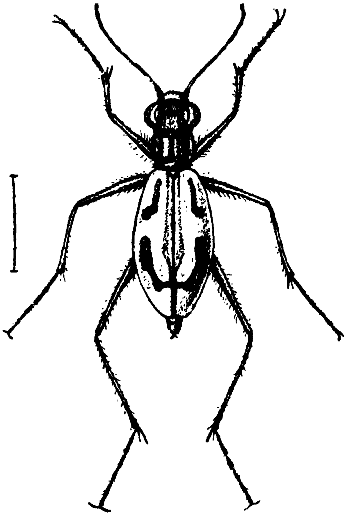
Fig. 192.—*Cicindela ornata.*

Length 11-12 millim.

SIND: Karachi, on the sands of Manorah (*Shopland*).

Extremely local, like the succeeding species, but not uncommon where it occurs.

204. **Cicindela copulata**, *Schm.-Goeb.*

Cicindela copulata, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 9.

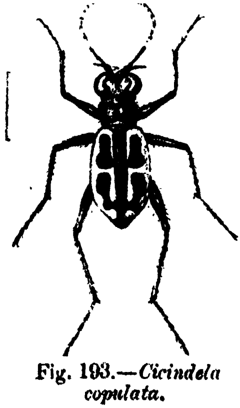
Fig. 193.—*Cicindela copulata.*

A very pretty and distinct little species. Labrum testaceous; head metallic, without pubescence, brilliantly red and very finely striated below the eyes, very finely sculptured in the middle and behind; eyes rather prominent; pronotum narrow, subcylindrical, about as long as broad, coppery, finely sculptured, with the central line slightly marked, disc bare; on the anterior and posterior margins are thick rows of very short setæ, and from the upper edge of the prosternum projects a border of long setæ, which appear to belong to the pronotum; scutellum coppery; elytra smooth and rather shiny, with extremely fine sculpture, ovate, bluntly pointed behind, apical sutural angle with a sharp spine, the suture broadly dark, and with two markings on each proceeding from this, one like an inverted mallet joined to the suture by its head (sometimes separated from the suture), and the other hatchet-shaped, joined to a process of the suture by the handle, extreme margins white, concolorous with the elytra; legs metallic, trochanters and apex of abdomen red; underside mostly bare, dark metallic, all the episterna covered with white pubescence, and the genæ bare.

Length 8 millim.

Bengal: Calcutta (*Helfer*) *; **Sind**: Karachi (*Bell & Shopland*).

Schmidt-Goebel describes the species in his 'Coleoptera of Burma,' but gives Cossipour, near Calcutta, as the only locality. The species is very local, and appears to have been met with very rarely.

GROUP 28.

A very distinct group, with the whole upper surface smooth, glabrous and shining, and the underside clothed with moderate or thick pubescence; the genæ are bare; the sides of the pronotum proper are not setose, but the prosternum, which is more or less thickly setose, is sometimes raised at the sides and displays the setæ from above.

I. Pronotum about as long as broad, or slightly transverse, subcylindrical.
  i. Elytra less parallel-sided, bronze green with a broad white margin ...... *limbata*, Schm.-Goeb., p. 431.
  ii. Elytra more parallel-sided, very variable in markings.................. *biramosa*, F., p. 431.
II. Pronotum distinctly transverse.
  i. Pronotum with the sides straight and parallel; elytra bronze green with a broad irregular testaceous margin.. *maindroni*, W. Horn, p. 432.
  ii. Pronotum with the sides more or less rounded.
    1. Elytra shorter and less parallel-sided, slightly widened behind, bright blue or bronze, with a very irregular broad testaceous margin; head and pronotum rather strongly sculptured, the latter more contracted behind .... *bellana*, W. Horn, p. 433.
    2. Elytra longer and more parallel-sided, not widened behind, with alternate bronze and testaceous longitudinal stripes, reaching from base to apex; head and pronotum very finely sculptured, the latter scarcely contracted behind ...... *quadrilineata*, F., p. 434.

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* Helfer's localities appear to be somewhat doubtful.

205. Cicindela limbata, *Schm.-Goeb.*

Cicindela limbata, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 7.

Of the size of *C. biramosa*, but with the elytra less parallel-sided, upperside bronze-green, underside violaceous; labrum testaceous; head finely rugose, bright green at the sides, eyes very large; pronotum slightly transverse, almost cylindrical, granulose; elytra bronze green, with a broad white margin; on the green portion is an interrupted row of large punctures, and the white edge is finely punctured; underside violaceous, with the sides thickly pubescent; legs bronze green.

Length 13 millim.

BURMA.

206. Cicindela biramosa, *F.*

Cicindela biramosa, Fabricius, Spec. Ins. i, 1781, p. 286; Dejean, Spec. Col. i, 1825, p. 133.
Cicindela tridentata, Thunberg, Nov. Ins. Sp. 1784, p. 26, fig. 40.
Cicindela biramosa var. *contracta*, Fleutiaux, Ann. Soc. Ent. France, 1893, p. 488.
Cicindela biramosa var. *dilatata*, Fleutiaux, l. c.

Very variable in size and extent of markings, shining and smooth, bronze or dark bronze-green with a coppery reflection, which is especially noticeable on the head and pronotum; labrum testaceous, head finely striated within the eyes, which are large and prominent; pronotum somewhat variable in length, as a rule about as long as broad, with the sides gently rounded, very finely sculptured, central line distinct but not strongly marked; elytra very shiny, sparsely sculptured, more distinctly in front than behind, with an irregular row of larger punctures near the suture, dark, with the margins more or less broadly white from the shoulder to the apex; from the margin at about the middle proceeds a blunt transverse spot, which reaches to about the middle of the disc, and the hinder white portion is thickened at its apex, the space forming a lunule continuing the margin; legs coppery and green, trochanters dark, metallic; underside coppery, green and violaceous, almost bare in the centre, with somewhat thick, but very fugitive pubescence at the sides; genæ bare; sides of prosternum with large punctures.

Length 10–14 millim.

CEYLON and SOUTHERN INDIA, generally distributed; BENGAL: Hugli River, Orissa, Chittagong, Sunderbunds; ANDAMAN Is.: BURMA; TENASSERIM; MALACCA; CHINA.

Many varieties occur. M. Fleutiaux (*l. c.*) says that the specimen from Tenasserim has the white markings inconspicuous and he proposes to call it var. *contracta*, this form having also occurred in Rangoon. The Ceylon examples, however, have the white markings much developed and for these he proposes the name of var. *dilatata*. The species appears to be found on or near the sea-coast, and not in forests; Helfer once found it in great abundance on the banks of the Hugli.

Mr. Annandale says of this common Indian insect (Annotated List of Insects in the Indian Museum, i, p. 30):—"I have only seen this beetle on the sea-shore, but wherever I have seen it, it has been extremely common. This is the case at Puri on the Orissa coast, at Pamben, on Raneswarem Island (Madura district, Madras), at Trivandrum and at Srayikad, on the Travancore coast. At none of these places did I ever meet with it at more than two hundred yards from the edge of the sea. At Trivandrum it was replaced in a very striking manner round the pools of rain-water just above the beach by *C. sumatrensis*, while at Balighai, near Puri, the same was the case, except that the landward species was there *C. cancellata*. *C. biramosa* does not occur, however, on every sandy beach within its limits of distribution, although all the places at which I have seen it have been of this nature. A careful search, conducted for several hours, at Verlakai, between Srayikad and Trivandrum, did not enable me to see a single specimen. *C. biramosa* is very active on the wing and is frequently mistaken for a digging-wasp. Apparently it flies by night as well as by day, for a considerable number of individuals flew to my lantern on the shore at Srayikad after dark. At Pamben I saw many individuals being captured and devoured by an Asilid fly. The food of the species seems to consist largely of insects which have fallen into the sea, or live naturally on the surface, and are washed ashore."

207. **Cicindela maindroni**, *W. Horn.*

Cicindela maindroni, W. Horn, Ent. Nachr. 1897, p. 98.

This is a much larger species than *C. biramosa*, to which it is closely allied, although it appears to be most nearly related to the Abyssinian species *C. rüppeli*, Guér. Labrum large, somewhat produced in front, white with the anterior margin very narrowly dark; clypeus, genæ and front of head shining green; head and pronotum dark greenish bronze, with more or less distinct coppery reflections, the former excavate between the eyes, which are very large; striation and sculpture very fine; pronotum subquadrate slightly transverse, with rows of very short setæ in front and behind, very finely sculptured, central line very slightly marked, sides almost straight and not rounded and narrowed behind as in *C. biramosa*; elytra broad, ample, slightly widened behind, closely and finely, but distinctly, sculptured, with an irregular row of larger punctures near the suture, bronze-green, with the side margins broadly testaceous from the shoulder to the apex, the colour being produced into a broad triangular dentate patch behind the middle, and a broad rounded patch before the apex, the apical portion being really, as in *C. biramosa*, an exaggerated form of the lunule so common in the genus; extreme side-margins metallic; legs green; trochanters red; apex of abdomen reddish testaceous; underside coppery green in front, violaceous behind, the sides, including all the episterna, clothed with thick tomentose pubescence, genæ bare.

Length 14–16 millim.

SIND: Karachi, Island of Kiamari, on clayey sands (*Maindron*); BALUCHISTAN.

208. **Cicindela bellana**, *W. Horn.*

Cicindela bellana, W. Horn, Deutsche Ent. Zit. 1905, p. 63.
Cicindela bellana ab. *nuda*, W. Horn, Syst. Ind. Cicind. (Feb. 1905), p. 38, note.

This species is intermediate between *C. biramosa* and *C. maindroni*; it differs from *C. maindroni* in being smaller, with the pronotum quite differently shaped and more distinctly sculptured; in the last-named species the base is almost broader than the apex, whereas in *C. bellana* it has the sides rounded and plainly narrowed and constricted at base; the broad light margins of the elytra are more irregular, being produced in front to the suture, and the apical patch is not curved; the dark markings, which are bronze-green, or sometimes bright blue, approach much nearer the margin in two places, and almost meet it behind; the trochanters, moreover, are metallic; in the shape of the head and eyes and in the pubescence of the underside it agrees with *C. maindroni*, and differs from *C. biramosa*, from which it may further be distinguished by the more cordate and more evidently sculptured pronotum and much more strongly punctured elytra. It is a very distinct and handsome species, especially the blue variety.

Length 12–14 millim.

SIND: Karachi (*Bell*); PERSIA: Fao (Brit. Mus.).

Var. **nuda**, *W. Horn.*

This variety has the upper surface entirely bronze-green, without or with hardly any testaceous markings; the specimens I have seen are entirely unicolorous.

Length 13 millim.

SIND: Karachi (*Bell*).

209. Cicindela quadrilineata, *F.*

Cicindela quadrilineata, Fabricius, Sp. Ins. i, 1781, p. 285; Olivier, Ent. ii, 1790, p. 25, pl. i, figs. 4 & 5; Dejean, Spec. Col. i, 1825, p. 132.
Cicindela renei, W. Horn, Ann. Mus. Genova, xxxvii, p. 273.

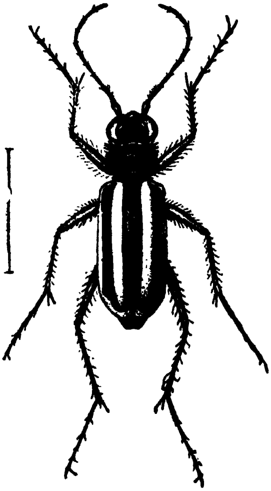

Fig. 194.—*Cicindela quadrilineata.*

A large, conspicuous, and well known species. Labrum short, testaceous, leaving a great part of the mandibles (which are testeceous, with black apex) exposed; maxillary palpi bright green, testaceous in the middle, labial palpi testaceous, last joint bright green; head dull coppery, brighter at the sides, excavate and very finely striated between the eyes, which are large and prominent; pronotum coppery, transverse, rounded at the sides, with strongly marked impressions in front and behind, and impressions at the sides joining these, formed by the raised edge of the prosternum, which is almost level with the disc of the pronotum and covered with long white setæ; disc very finely sculptured, with the central line not strongly marked; elytra long, rather broad, subparallel-sided, very gently rounded, with the oblique margin at the apex very plainly serrulate, the suture metallic, with a dark bronze longitudinal stripe on each side of it and attached to it (sometimes almost black, sometimes coppery), reaching from the base nearly to the apex, and including the scutellum; on the disc of each there is another stripe of the same description, reaching from the base, but not quite touching it, nearly to the apex, and either joining or separate from the apex of the sutural band; as a rule they are joined and the outer band is notched a little before the apex, but they are variable in size and regularity; extreme margins testaceous, concolorous with the ground-colour; upper surface distinctly punctured, apical sutural angle with a sharp spine in both sexes; legs green and coppery, trochanters metallic; underside coppery, with the sides, including all the episterna, thickly pubescent, sides of pronotum with large punctures.

Length 15–17 millim.

This species is a very characteristic Indian beetle and apparently occurs from Ceylon to North India; M. Maindron says (Cicindélides de Sind, Ann. Soc. Ent. France, 1899, p. 381) that he has found it from Tenasserim to the North, and that it is common on the sands of Manorah near Karachi, where it has been taken by

Captain Shopland in company with *C. ornata*; it also occurs in Baluchistan. The colour of the light bands varies, being sometimes yellowish or dusky yellow, and sometimes almost clear white.

Var. **renei**, *W. Horn.*

This variety chiefly differs in having the bronze stripes on the disc much reduced, and sometimes interrupted, so that much more of the pale ground-colour is visible; the elytra are slightly more ovate, with the shoulders a little less marked.

Length 15–16 millim.

CEYLON; MADRAS: Trichinopoli; SIND: Karachi.

A variety described by Bates as *C. millingeni* is found at Bushire in the Persian Gulf, which resembles the var. *renei* in the prevalence of the pale colouring.

As in *C. biramosa* which in variation much resembles *C. quadrilineata*, transitional examples occur which fill up all the gaps between the specimens in which the light and dark colour prevails; but the races are local, and M. Maindron (*l. c.*) says that the typical form is found only in Tenasserim and Burma. The Sind specimens, however, appear to be typical, and I have a typical example before me from Madras; though it does not appear to be quite settled what the typical form really is.

GROUP 29.

The small species (6–6½ mm.) which constitutes this group may be known by being the only Indian species that has the epipleuræ of the elytra furnished with long pubescence at the sides of the metasternum; the underside is thickly pubescent, except the prosternum and genæ, which are scantily pubescent; the species is also characterised by the great length of the legs, especially of the posterior pair.

210. **Cicindela phalangioides**, *Schm.-Goeb.*

Cicindela phalangioides, Schmidt-Goebel, Faun. Col. Birm. 1846, p. 18.

A very small species, with very long legs; head moderately strongly excavate, very finely striate in front, with green, red, and bluish reflections, the frontal sulci being sometimes bright blue; pronotum short, rounded at the sides, very finely sculptured, comparatively smooth, golden-red or green on the disc, the margins blue or greenish blue; elytra parallel-sided, obliquely truncate on each side just before the apex, very closely and finely sculptured, the upper surface having a dull and finely shagreened appearance, obscurely metallic, with a small spot at the shoulders and the whole edges from the shoulders white; underside, from the

pronotum to the apex, with thick whitish pubescence, epipleuræ with light hairs; legs very long, especially the hinder pair, partly metallic and partly testaceous, femora much thickened at the base, tibiæ slightly thickened at the apex.

Length 6–6½ millim.

BURMA: Pegu.

A scarce species, known from no other locality. The colour appears to be variable and occasionally the margins of the elytra are blue.

GROUP 30.

Small species (7½–9 mm.) with the elytra subparallel-sided and usually subrectangular; episterna of metasternum very scantily pubescent or bare; genæ bare; elytra unicolorous, or with white markings at the margins only, or with the whole margins narrowly white.

I. Elytra depressed and dull, with the shoulders more marked.	
i. Pronotum broad, subquadrate, dull, with the sides straighter and almost parallel, extremely finely sculptured; elytra with a narrow well defined, white border, the rest being unicolorous	*limosa*, Saund., p. 436.
ii. Pronotum much narrower, slightly longer than broad, rather shiny, with the sculpture comparatively strong; elytra with a humeral spot, an elongate, broadly triangular spot at the sides, and the apical margin narrowly white	*andersoni*, Gestro, p. 437.
iii. Pronotum about as long as broad with the basal angles strongly produced, finely but distinctly sculptured; elytra unicolorous ..	*malabarica*, Maindr. & Fleut., [p. 438.
II. Elytra convex and shiny, with the shoulders less marked; pronotum strongly rounded in front; elytra very rarely unicolorous (var. *immarginata*, W. Horn), as a rule with the margins narrowly white	*gyllenhali*, Dej., p. 438.

211. Cicindela limosa, *Saund.*

Cicindela limosa, Saunders, Trans. Ent. Soc. Lond. 1834, p. 64, pl. 7, fig. 6; Schmidt-Goebel, Faun. Col. Birm. 1846, p. 7.
Cicindela cinctella, Chevrolat, Le Nat. 1882, p. 73.

A small species of a dull greenish bronze colour, with the elytra subrectangular, much broader at the base than pronotum, with the margins narrowly white, and the disc without markings and unicolorous; labrum testaceous, narrow, leaving the greater part of the mandibles exposed; the latter large, testaceous, with black apex; head broad between the eyes, which are moderately prominent, dull bronze-green, with slight coppery reflection, and with two obscure dark blue lines in front, sculpture very fine, striation near eyes only visible under a somewhat high magnifying power; pronotum subquadrate, about as long as broad, with the sides almost straight, very slightly narrowed behind, anterior and posterior depressions well marked, central line feebly marked, sculpture exceedingly fine, upper surface dull and coloured like the head; elytra almost parallel-sided, of equal breadth at base and apex, much broader than the base of the pronotum, with the shoulders well marked and deeply impressed between the shoulders and scutellum; closely asperately and distinctly sculptured in front, more obsoletely behind; legs long, green, knees and underside of tibiæ more or less red, tibiæ more or less fuscous, trochanters clear red; underside coppery, with the sides of the abdomen, the mesosternum and the edge of the posterior coxæ thickly pubescent, episterna of metasternum scantily pubescent, episterna of prosternum and the genæ bare.

Length 9 millim.

SIKKIM: Mungphu; BURMA: Pegu; ANDAMAN ISLANDS; NICOBAR ISLANDS; CEYLON; CHUSAN ISLANDS.

212. Cicindela andersoni, *Gestro.*

Cicindela andersoni, Gestro, Ann. Mus. Genova, 1889, p. 83.

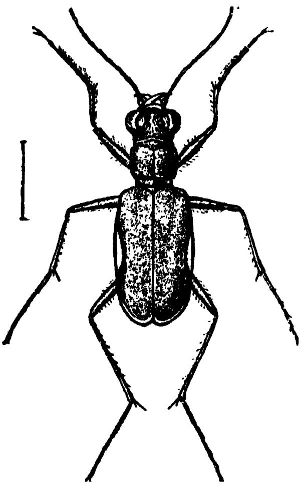

Fig. 195.—*Cicindela andersoni.*

Very like the preceding at first sight in shape and colour, (obscure greenish-bronze, very dull), but easily distinguished by the narrower and more rounded pronotum, and the narrower elytra which are subrectangular and parallel-sided, but are rather more abruptly oblique at the apex and are much narrower in proportion to the pronotum, with the shoulders not so much marked; the margin, moreover, is not entirely white, but there is a white patch at the shoulders, a large long, very obtusely angled triangular spot at the middle, and a marginal line at the apex; the trochanters are red as in *C. limosa,* and the pubescence is much the same, but more scanty, the episterna of the metasternum being almost bare; the sides of the head and pronotum are more brightly metallic; in the female there is on each elytron a bright dark round area before the middle.

Length 7–9½ millim.

BURMA: Teinzo, Karen Hills, North Chin Hills.

213. Cicindela malabarica, *Maind. & Fleut.*

Cicindela malabarica, Maindron & Fleutiaux, Bull. Soc. Ent. France, 1903, p. 72.

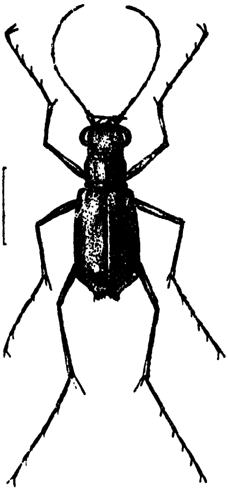

Fig. 196.—*Cicindela malabarica.*

Obscurely æneous, almost black, dull unicolorous, without markings of any kind; labrum and mandibles dark, head rather broad between the eyes, which are large and prominent, very finely striated and sculptured; pronotum about as long as broad, with the anterior angles rounded, and the posterior angles much produced, especially in the female, so that the base appears to be broader than the apex, sculpture more evident on the margins than on the disc, impressions fairly strong, central line scarcely traceable; elytra considerably narrower in the male than in the female, without markings, very finely sculptured; legs very long, femora obscurely violaceous, tibiæ, tarsi, and trochanters dark; pubescence of the underside, which is shining and more or less violaceous, very scanty; episterna and genæ bare.

Length 7½–9½ millim.

MADRAS: Mahé (*Maindron*).

214. Cicindela gyllenhali, *Dej.*

Cicindela gyllenhali, Dejean, Spec. Col. i, 1825, p. 143.
Cicindela gyllenhali var. *immarginata*, W. Horn, Deutsche Ent. Zeitschr. 1892, p. 81.

This species resembles *C. limosa* in size and general appearance and especially in having the sides of the elytra narrowly white and the disc without any markings, but it is much more shining and convex, and has the frontal striation more evident, the pronotum much more rounded, the elytra more convex and the whole of the upper surface shiny instead of dull; the colour is obscure greenish bronze, and the general appearance, when viewed from above, is very like that of *C. bellana* var. *nuda*, Horn, but the present insect is a much smaller one. Head with the eyes large and prominent, the juxta-ocular striation being very distinct, and the hinder part finely sculptured; pronotum with the sculpture finely but distinctly asperate; contracted at the base and with the impressions and central line well marked; elytra convex and shining, closely and distinctly sculptured, with traces of an irregular larger row of punctures on each side near the suture; legs metallic, trochanters and knees red: underside coppery and green, darker behind, with the sides of the abdomen scantily, and the edge of the posterior coxæ thickly pubescent, episterna bare; the spine at the sutural apical angle is very evident.

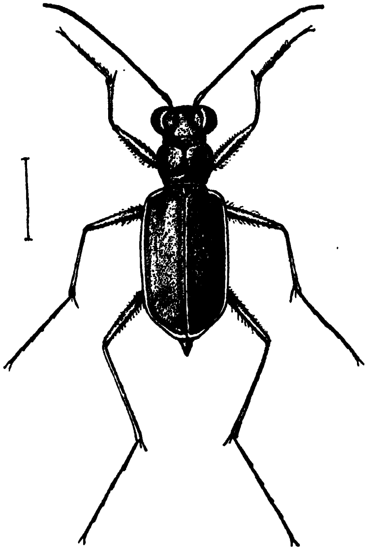

Fig. 197.—*Cicindela gyllenhali.*

Length 9–9½ millim.

BOMBAY: Bandra (*Jayakar*); SIND: Karachi (*Bell*).

Var. **immarginata**, *W. Horn.*

This variety has the elytra concolorous, without the white margin. Dr. Horn described it on one female specimen, but gives no locality.

[In the Annotated List of Asiatic beetles in the collection of the Indian Museum (Cicindelidæ, Dr. Annandale and Dr. Horn), among the localities given for *C. burmeisteri*, Fisch. var. *stoliczkana*, Bates (Proc. Zool. Soc. London, 1878, p. 713) are Kashmir and the Jhelum Valley. Dr. Horn, however, informs me that the Kashmir locality was given under a misapprehension, and the insect cannot therefore at present be included in the Indian list although it appears to be very probable that it may occur.]

Genus APTEROESSA.

Cicindela, Fabricius, Sp. Ins. i, 1781, p. 282 (*ex parte*).
Apteroessa, Hope, Col. Man. ii, 1838, p. 169, pl. ii, fig. 1.

Type, *Cicindela grossa*, F.

The single species belonging to this genus is characterized by being apterous and by its thick clumsy and heavy form, in which it differs from any species of the genus *Cicindela*. Unfortunately, as Dr. Horn observes (Deutsche Ent. Zeitschr. 1899, p. 47), there is not an even moderately good example in existence; all that are known at present are the Fabrician type in the British Museum, from which the description given below is taken, and which is well figured as regards outline by Westwood, in Hope's Manual (*l. c. supra*); an example without extremities in Dr. Horn's collection; and the abdomen of a third in the Berlin Museum. It is probably extremely local, and it is quite possible that some collector may turn it up in numbers somewhere in the district adjoining the Coromandel Coast, if this be the true locality.

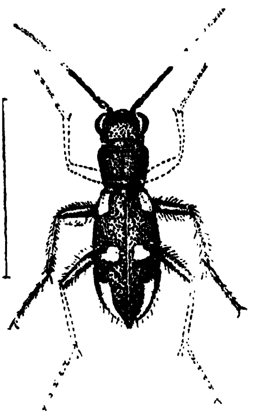
Fig. 198.—*Apteroessa grossa.*

215. Apteroessa grossa, *F.*

Cicindela grossa, Fabricius, Sp. Ins. i, 1781, p. 282.
Apteroessa grossa, Hope, Col. Man. ii, 1838, p. 169, pl. ii, fig. 1.

A large, strongly and coarsely built species, black, with yellow markings on the elytra; labrum short, yellow, bluntly dentate, with the margins dark and with two dark spots touching the basal margin; mandibles large, strong, pale, with the teeth, tips and outer edge dark; antennæ (in the specimen described) almost entirely wanting, but apparently stout and dark; head very large, eyes small and not very prominent, with strongly raised dark inner borders, space between the eyes flat and rugosely sculptured, occiput also coarsely sculptured; near the eyes are some coarse white setæ; pronotum in front about as broad as the head with the eyes, with the sides gradually rounded, very slightly widened in front and then narrowed rather strongly at the base, very coarsely sculptured, especially in front, with strong depressions in front and behind (the anterior depression being situated at some distance from the margin, very strong, and quite cutting off the front portion), central line feebly marked; at the sides there are scattered setæ; scutellum large, almost smooth; elytra ovate, convex, duller than the front parts, with the shoulders quite rounded off, gradually rounded to apex, with scattered and not close punctuation throughout (the bottom of the punctures being green), and with smaller and finer, sparingly distributed punctures between them; the punctuation is much stronger at the sides, which are brighter and show traces of violaceous reflection, the extreme margins being metallic green, and the epipleuræ ferruginous; the yellow markings are conspicuous: there are three on each elytron, one at the base, oblong, not touching the side margin, one behind the middle almost circular, but produced a little towards the margin, and a third, oblique, at the apex; at and before the apex there are distinct coarse outstanding setæ; legs stout, setose; underside, in the Fabrician specimen, with the sides of the prosternum and the apex of the abdomen almost bare, and the rest of the sides pubescent. Dr. Horn, however, speaks of the forehead, pronotum, epipleuræ of the elytra, the genæ, and all the side-parts of the body as furnished with pubescence, and speaking of the peculiar setæ at the apex of the elytra, he says that, as on the whole upper surface, besides the deeper punctures, there are finer scattered punctures, he does not consider it impossible that in fresh examples the whole upper surface is covered with setose hairs.

Length 21–22 millim.

Madras: Coromandel, Tranquebar.

No specimen has been taken for more than a hundred years.

Subfamily MEGACEPHALINÆ.

Rather large and conspicuous insects, with the head, as a rule, much developed; but this is not always the case, as in *Oxycheila* it is only of moderate size; the palpi are elongate, the labial palpi being longer than the maxillary, and the third joint of the latter is longer than the fourth; they are very active insects, but are, in certain cases, apterous. The family is only represented by one species which has a very wide range in the Palæarctic and Oriental regions.

Genus **MEGACEPHALA.**

Megacephala, Latreille, Hist. Nat. Ins. iii, p. 79.
Tetracha, Hope, Col. Man. ii, p. 6.

Type, *Cicindela senegalensis*, Linné.

There seems to be no sufficient reason for separating *Megacephala* and *Tetracha*. The latter was separated by Westwood and Horn on the ground that the mandibles have four apical teeth, instead of three as in the first mentioned genus; besides this they have the shoulders of the elytra nearly always well marked, because the wings are well developed; the first three joints of the anterior tarsi are dilated in the male, and spongy-pubescent beneath. The type of *Tetracha* is *Cicindela carolina*, Linné. The species belonging to *Tetracha* belong to the New World, those placed under *Megacephala* to the Old.

216. **Megacephala euphratica**, *Dej.*

Megacephala euphratica, Latreille & Dejean, Hist. Nat. Col. Eur. i, 1822, p. 37, pl. i, fig. 4.
Tetracha euphratica, Lacordaire, Gen. Col. i, 1854, p. 13.
Var. *Megacephala armeniaca*, Castelnau, Rev. Ent. Silb. ii, 1834, p. 28.

A stout robust species, with the front parts not much narrower than the elytra; head and pronotum green, with more or less obscure violaceous reflections, labrum and mouth-parts mostly testaceous, mandibles large and powerful, dark towards apex; head large, about as broad as pronotum, not contracted behind, eyes large and prominent; sculpture of head very fine, coarsely alutaceous, stronger near the eyes where it is striate; antennæ slender, testaceous, with long setæ at the apex of the joints; pronotum widest in front, subcordiform, gradually narrowed to the base, with two transverse furrows (angulate in the centre) and a strong central channel; elytra oblong, slightly rounded at the sides, green, with the apex broadly testaceous, the space before this and more or less of the space near suture being of a purplish colour, sculpture strong and asperate in front, much finer behind; legs long, testaceous, coxæ and trochanters also testaceous or pitchy-testaceous; underside bluish green, blue or purple with the apical part of the abdomen dark; shoulders well marked.

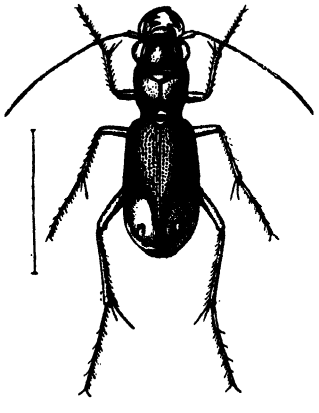

Fig. 199.—*Megacephala euphratica.*

Length 19–26 millim.

SIND: Karachi. Widely distributed from Spain to Persia.

Horn and Annandale (Catalogue of Asiatic Beetles in the Indian Museum, Part i, p. 5) say that the geographical area of the priority-form of this species, the only representative of the group in the Palæarctic and Oriental regions, is very remarkable:—

Cartagena (South Spain), Andalusia, Algeria to Tripoli, Egypt, Gulf of Tadjura (Obock), Sinai, Syria, Rhodes, Cyprus, Caucasus, the Euphrates, Persia and Karachi.

Var. **armeniaca**, *Cast.*

This is the bluish form of the species.

The localities recorded for this variety are:—United Provinces: Agra (*Thomson*); Perso-Baluch Frontier or Seistan (Seistan Expedition, 1903); Afghan-Baluch Frontier (Afghan Boundary Commission, 1896). It also occurs in Armenia, and in Transcaspia, up to the Amu Daria in Seistan (*Horn*).

PAUSSIDÆ.

Structure.

Form rectangular, longer or shorter, usually more or less depressed, but sometimes very convex, rarely subcylindrical; size very variable.

Head variable in shape, usually narrower than the pronotum, sometimes very short, small, and transverse, sometimes large, more or less hexagonal, and much produced before the eyes. *Eyes* sometimes large and prominent, occupying practically the whole of the sides of the head, sometimes comparatively small and scarcely at all prominent; temples usually, but not always, more or less visible behind the eyes. *Antennæ* inserted on the front, under the frontal ridge (if it is present), extremely variable and abnormal, with from two to eleven joints. *Labium* transverse, subquadrangular, or spoon-shaped, sometimes subtriangular, with the anterior margin truncate, subtruncate, or more or less emarginate; paraglossæ wanting, or scarcely traceable. *Mandibles* short, stout, and curved, almost always unidentate. *Maxillæ* very variable, the external lobe being often wanting, and even when present as a rule very narrow and sometimes styliform; it is in some cases reduced to a prominence or a tooth. *Maxillary* and *labial palpi* very variable and affording tribal and generic distinctions; these will be treated of below under the various headings of the divisions of the family.

Pronotum also extremely variable, and affording in certain cases generic distinctions, sometimes simple, sometimes more or less divided by a furrow, and in the case of the genus *Paussus* often completely divided by a large transverse excavation, which is in many cases furnished at the sides with tufts of yellow pubescence. The latter appear to be secretory and to have some connection with the myrmecophilous habits of the species. *Mesonotum*: a small triangular scutellum is visible which is very rarely absent. The *prosternum* has the episterna large, but the epimera very small and obsolete. *Mesosternum* transverse, with the episterna well marked, but with the epimera scarcely traceable. *Metasternum* usually large, but shorter in some genera than in others, with the episterna large and variable, usually in the form of an elongate triangle, visible along the whole length, or partly hidden by the epipleuræ of the elytra; epimera very small and almost always completely hidden by the elytra.

Elytra oblong, more or less rectangular, rarely subcylindrical, never dehiscent, and usually leaving the pygidium uncovered; the sculpture is usually very fine; the shoulders are often well marked and prominent, and at the sides, just before apex, there is in the majority of cases, a small expansion or fold.

Wings well developed in all cases, with somewhat irregular and broken venation, but plainly of the adephagid type (*vide* p. 41).

Legs almost always robust, with the femora and tibiæ often much dilated and compressed; coxæ of the anterior and intermediate pairs round, of the posterior transverse; trochanters large and well developed; tarsi always five-jointed, with the last joint elongate, sometimes as long as the four preceding together; all the joints are simple and entire and never bilobed; in some genera the first four are dilated and strongly pubescent beneath in the male; the claws are always two in number, and are strong and simple.

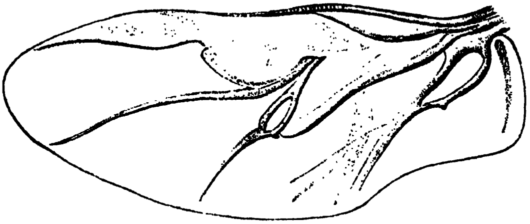

Fig. 200.—Wing of *Paussus lætus*, Gerst.; Abyssinia. (After Raffray.)

Abdomen with five ventral segments visible along the middle and six at the sides, as is generally the case in the families of the ADEPHAGA. Stigmata, fourteen (Raffray) or sixteen (Desneux) abdominal, and four thoracic. The shape of the genital armatures is very variable, and affords good characters, but this need not be discussed here; a detailed account will be found in Raffray's work (Nouv. Arch. Mus. Paris, (2) viii, 1885, p. 325) and several of the armatures have been figured by him.

Habits.

We have already discussed, in the general Introduction, the question of the position of the PAUSSIDÆ, and this need not again be referred to. The habits of the family are very interesting. Its members are mainly, if not entirely, myrmecophilous, and they appear to be almost exclusively found in or near ants' nests, or flying to light. They have the power of crepitating, and discharge a volatile fluid from the anus, with an explosion. This fluid is caustic and discolours the flesh; Loman, and after him Escherich, have recognized in it the presence of free iodine. Some of the larger species, such as *Cerapterus stali* (which is almost as large as a *Geotrupes*), make quite an alarming noise when disturbed. Besides this defensive secretion, it is evident that a large number of the species have the power of secreting a substance that is pleasing or nourishing to the ants with which they live, and the tufts of hairs which are found in the division of the pronotum in *Paussus*, at the lateral basal edges of the same in *Pleuropterus*, and in other situations in other species or genera, are probably the centres or, at all events, the holders of this secretion. As a rule the PAUSSIDÆ live in the nests of terrestrial ants, but, as pointed out by Sharp, they have been found in nests of *Cremastogaster* in the spines of *Acacia fistulosa*. Wasmann, who has paid more attention to this subject than anyone else, says that most of the PAUSSIDÆ, whose hosts are known (and there are comparatively few) live with species of the genus *Pheidole*; only a few live with *Acantholepis*, *Cremastogaster*, *Aphœnogaster*, *Ischnomyrmex*, and *Tetramorium* (*Xiphomyrmex*). A new and very strange species of *Paussus* (*P. desneuxi*) will be found described in this volume (p. 475), which was taken in a nest of *Tetramorium tortuosum*.

Early Stages.

Erichson published a description of a larva which he believed to belong unquestionably to this family, but he appears to have been in error, and, as a matter of fact, authentic larvæ have only quite recently been discovered. These are described by Dr. A. G. Böving (Vidensk. Meddel. naturh. Foren. Copenhagen, 1907, p. 133), who says that several larvæ, pupæ, and imagines of *P. kannegieteri*, Wasm., were found by Dr. Hjalmar Jenson, of Buitenzorg, in an ants'-nest at Pangerango, Java. The insects are in the Zoological Museum at Copenhagen, and their identity is quite certain, because the characteristic antennæ of the group can be seen under the pupal skin in one of the specimens. The larva (of which excellent figures are given by Dr. Böving) is typically carnivorous, and is eminently adapted for a myrmecophilous life, bearing a strong resemblance in many points to the termitophilous larvæ of the Carabids, *Glyptus sculptilis* and *Physocrotaphus ceylonicus*. It is broad, with the thoracic and abdominal segments much swollen, and is remarkable from the fact that the mandibles have on their inner side a moveable prostheca or additional lobe; the eyes are rudimentary or wanting; in many points it resembles the Carabid larvæ, but differs in the construction of the mandibles, the legs, and the eighth abdominal segment. Böving's translation is somewhat involved and hard to understand, but apparently he means that it is fundamentally, but not superficially, Adephagid, for he says, "the larva cannot be called Carabiform at all, though, on the other hand, it has to belong to the Coleoptera Adephaga, just like the Carabiform larva."

The chief writer on the family is Westwood, who paid particular attention to it, and in his well known, but expensive works, 'Arcana Entomologica' (1845) and 'Thesaurus Entomologicus oxoniensis' (1873), described and figured nearly all the known species. In 1887 Raffray published his well known work "Matériaux pour servir à l'étude des Coléoptères de la Famille des Paussides" (Nouv. Arch. Mus. Paris), and since that time

Wasmann has done much good work at the family, having been led to study it through the myrmecophilous habits of its members. Several species have since that time been described by Gestro, who in 1901 (Ann. Mus. Genova (2) xx, pp. 811–850) published a systematic catalogue of the Paussidæ, which was made use of by Desneux in the most recent work on the family (Genera Insectorum (Wytsman), Paussidæ, 1905). I have obtained much help from all the books above mentioned, and am especially indebted to M. Desneux (and so indirectly to Dr. Gestro) for saving me much trouble with regard to the bibliography and references. I would also thank Father Wasmann for kindly sending me several valuable papers, and Mr. C. O. Waterhouse, Mr. G. J. Arrow, and Mr. H. E. Andrewes for much help with specimens.

Table of Subfamilies.

I. Antennæ eleven-jointed, moniliform ..	**Protopaussinæ**, p. 447.
II. Antennæ with from two to ten joints which are always more or less dilated and compressed, and are extremely variable.	
1. Maxillary and labial palpi longer and less thickened, not concealing the buccal cavity; antennæ with from six to ten joints	**Cerapterinæ**, p. 449.
2. Maxillary and labial palpi shorter and much thickened, completely hiding, when at rest, the buccal cavity; antennæ with from two to six joints (mostly two-jointed)	**Paussinæ**, p. 453.

Subfamily PROTOPAUSSINÆ.

This subfamily consists of one genus and two remarkable species, which are characterized by having the antennæ eleven-jointed, long, slender, and cylindrical, thus approaching closely to the Carabideous type; the palpi are large and free, the labial consisting of three joints and the maxillary of four.

Genus **PROTOPAUSSUS.**

Protopaussus, Gestro, Ann. Mus. Genova, xxxii, 1892, p. 706.

Form elongate-oblong, depressed; head short, eyes large and prominent, with a slight emargination behind; antennæ long and slender, with eleven free joints, the second the shortest, the third longer, and the following more or less moniliform, the eleventh being longer than the preceding and rounded at its apex; mandibles strongly arcuate, with the extremity sharp and pointed; maxillary palpi 4-jointed, with the first joint rather short, subcylindrical, the second longer, slightly subconical, the third rather larger, and the fourth longer, somewhat fusiform and narrowed at the apex; labial palpi 3-jointed, with the last joint about twice as long as the second, narrowed towards the apex, which is subtruncate; ligula large, ovate, setose at the apex; pronotum formed much after the style of *Euplatyrhopalus aplustrifer*, Westw., the front part having the sides much expanded and produced behind, and the posterior part forming a broad collum or neck; elytra long, parallel-sided, entirely covering the abdomen, with the shoulders much produced and almost meeting the tufts of hairs on the posterior angles of the front part of the pronotum; legs rather short, very slightly compressed, tibiæ without spurs.

Range. Two species only are known of this peculiar genus, one taken by Fea in Burma, and the other (two specimens) in China by J. J. Walker. It is especially interesting as being a primitive form, and as connecting *Paussus* more closely with the CARABIDÆ. The species were not found in company with ants, but as they have, as pointed out by Desneux (Genera Insectorum, PAUSSIDÆ, p. 7), the cœnogenetic character of secreting tufts of hairs on the pronotum, they are probably associated with them.

217. **Protopaussus feæ**, *Gestro.*

Protopaussus feæ, Gestro, Ann. Mus. Genova, xxxii, 1892, p. 706.

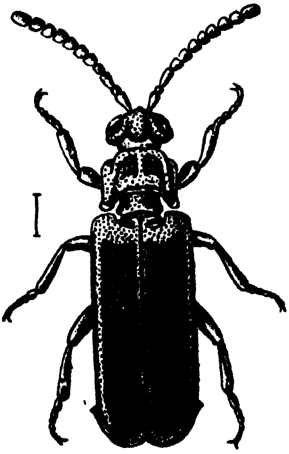

Fig. 201.—*Protopaussus feæ.* (After Desneux.)

Elongate-oblong, shining, head and pronotum of a light pitchy testaceous colour; head short and broad, raised in the middle, with the eyes large and prominent, occupying the whole of the sides; antennæ long and slender, as long as head, pronotum, and a fourth part of the elytra; pronotum transverse, the anterior part broad and crescent-shaped, expanded at the sides, with two large impressions on the disc, divided by a longitudinal raised line, posterior angles bluntly and strongly produced and terminating in a fascicle of hairs, the posterior part forming a distinct collum or neck, which is not quite as wide as the head with the eyes; elytra long, parallel-sided, punctured, with the humeral angles strongly and roundly produced so that they embrace the base of the posterior portion of the pronotum; black, with the base more broadly, and the suture, apex and margins very narrowly, yellowish ferruginous; expansions at apex narrow, but distinct; pygidium completely covered; legs moderate, rather slender, pitchy, with the tarsi testaceous, and the tibiæ longitudinally striated; the apex of the latter and the tarsi are clothed with yellow silky hairs; underside brownish testaceous.

Length 5½–6 millim.

BURMA (*Fea*).

Subfamily CERAPTERINÆ.

This subfamily contains five genera: *Homopterus*, which contains two species from South America; *Cerapterus*, which is represented by thirteen African and two Asiatic species; *Arthopterus*, which comprises four African species, but is distinctively an Australian genus, no fewer than fifty species having been described from that region; *Pleuropterus*, containing eight African and three Asiatic species, two of which occur in Ceylon and India; and *Pentaplatarthrus*, all of which are African. The species are characterized by having the labial and maxillary palpi long and free and never concealing the buccal cavity beneath them, which is always open (fig. 202); the antennæ are made up of from six to ten joints, which are always more or less strongly enlarged and compressed, but very variable.

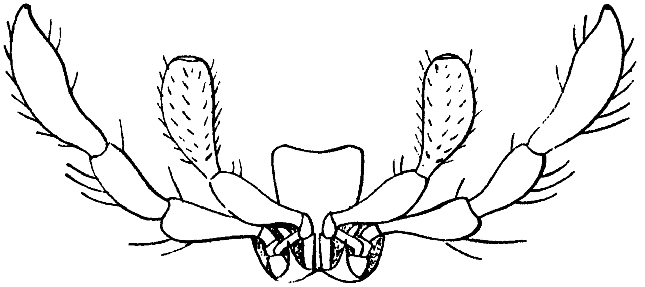

Fig. 202.—Mouth-parts of *Pleuropterus westermanni*, Westwood (Malay Region), viewed from the underside (after Raffray).

Table of Genera.

I. Antennæ composed of ten joints, all free; labial palpi very robust, with the last joint very much enlarged, strongly truncate and excavate at the apex	CERAPTERUS, Swed., p. 450.
II. Antennæ composed of ten joints, joints 2–10 soldered together; labial palpi comparatively slender, with the last joint not markedly enlarged or truncate at the apex.	PLEUROPTERUS, Westw., p. 451.

Genus CERAPTERUS.

Cerapterus, Swederus, Kongl. Vet. Akad. Handl. ix, 1788, p. 203; Westwood, Arcan. Ent. ii, 1845, p. 6; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, p. 336.
Orthopterus, Westwood (subgenus), Ent. Mag. v, 1838, p. 502.
Euthysoma, Thomson, Mus. Scient. ii, 1860, p. 68.

Form short, broad, convex, and thick-set; head small, short, transverse, with a short neck; eyes large and prominent; antennæ 10-jointed, with the first joint subquadrate, much narrower than the following, which are very broad and compressed, 2–9 very narrow, subequal, 10 much longer (as long as the three preceding), rounded at the apex; maxillæ bilobed, maxillary palpi with four joints, the first shorter than the second, the third half as long as the second, and the fourth almost as long as the three preceding, narrowed at the apex; labial palpi very stout, three-jointed, the first joint very small, the second much larger, enlarged in front, and the third very large, cup-shaped, and with its apex excavate; pronotum short, very transverse, with the sides rounded; legs short, with the femora and tibiæ very broad, the latter very strongly compressed; tarsi short, partly fitting into grooves on the tibiæ, the first four joints very short, in the female hardly broader than the fifth, in the male strongly dilated transversely and thickly pilose on their underside.

Range. The genus is mainly African; one species, however, occurs in Java and one in India.

218. **Cerapterus latipes**, *Swed.*

Cerapterus latipes, Swederus, Kongl. Vet. Akad. Handl. ix, 1788, p. 203, pl. 6, fig. 1; Westwood, Arcan. Ent. ii, 1845, p. 6, pl. 49, fig. 1.

Short and broad, oblong, convex, pitchy, shining, with the front parts pitchy red or dark ferruginous; head small and short, with large eyes, which do not however take up the whole of the sides as the temples are narrowly visible behind them, vertex rather strongly punctured; antennæ red; pronotum with the sides and angles rounded, smooth and shining, feebly channelled in the middle, finely setose at the sides; elytra as broad as the pronotum, parallel-sided, very finely sculptured, dark, with an irregular yellowish dentate spot on each before the apex, which does not touch the suture or the margins; pygidium scarcely visibly punctured; legs red, femora and tibiæ strongly punctured on their underside; Underside pitchy or pitchy red.

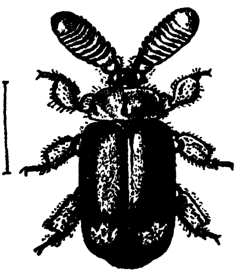

Fig. 203.
Cerapterus latipes.

Length 11–12 millim.

CEYLON; MADRAS: Nilgiri Hills; BENGAL; BURMA.

Widely distributed and probably not uncommon throughout India.

Genus PLEUROPTERUS.

Cerapterus, subg. *Pleuropterus*, Westwood, Trans. Linn. Soc. Lond. xviii, 1841, p. 585; id., Arcan. Ent. ii, 1845, p. 9.
Pleuropterus, Raffray, Nouv. Arch. Mus. Paris (2) viii, 1885, p. 338.
Heteropaussus, Thomson, Mus. Scient. ii, 1860, p. 70.

Form elongate oblong, somewhat depressed; head always narrower than the pronotum; eyes prominent, occupying the whole of the sides of the head, scarcely any portion of the temples being visible behind them; antennæ long and flat, with ten joints, the first free, quadrangular, much narrower than the following, the rest broad and compressed and soldered together, the second produced strongly externally, 3–9 subequal, 10 at least as long as the two preceding and rounded at the apex; maxillary palpi 4-jointed, with the first joint very small and narrow, the two next almost equal in size, and the last a little longer, thickened in the middle and a little narrowed towards the apex; labial palpi 3-jointed, with the first joint small, the second long, and the third of about the same length but broader and truncate at apex; pronotum always transverse, but varying somewhat in shape, raised in the middle, excavate at the sides, with the posterior angles either truncate or more or less sharp; elytra with or without longitudinal ridges or traces of ridges, rather brightly coloured; legs rather long and slender, with the femora somewhat compressed; tarsi long, with the first four joints hairy, the second being the longest, and the last joint long and narrow.

Range. Two species belong to the Indian region, and a third to the Malay region; the remainder are African.

Key to the Species.

I. Size larger (9–10 mm.); pronotum with the sides bluntly angled, their greatest breadth being just about the middle	*taprobanensis*, Gestro, p. 451.
II. Size smaller (7¾–8¼ mm.); pronotum with the sides narrowly rounded and not angled, their greatest breadth being distinctly behind the middle	*cardoni*, Gestro, p. 452.

219. Pleuropterus taprobanensis, *Gestro*.

Pleuropterus taprobanensis, Gestro, Ann. Mus. Genova, 1901, p. 821 fig. 2; Wasmann, Notes Leyden Mus. xxv, 1904, p. 14.
Pleuropterus westermanni, Raffray (*nec* Westwood), Nouv. Arch. Mus. Paris, viii, 1883, p. 37, pl. 15, fig. 4, & pl. 17, fig. 1.

Somewhat depressed, moderately broad, shining; head very short, dark rufous, with large and prominent eyes, occupying the whole of the sides, but with the temples just visible behind them, vertex uneven and rather strongly punctured; antennæ rufescent, long, and shining; pronotum ferruginous, much broader than long, strongly raised at the margins, which are bluntly angled, and with its greatest breadth just about the middle; the central part is raised and more or less channelled in the centre, and the sides are strongly excavate; the base is depressed, and the central raised part divides before the triangular depression and leads off on either side to the bluntly-produced posterior angles; on each side, just before these angles, there is a small stiff tuft of setæ, which at first sight looks like a tooth; elytra oblong, parallel-sided, broader than the pronotum, red or yellowish red, with two broad elongate patches (one on each side of the suture) near the base, another at each shoulder, variable in extent, and another on each side before the apex, also variable both in size and shape, black; just behind the base, on the outer sides of the two basal black patches, the surface of each elytron is raised into a curved costa, the part between these being depressed: the sculpture is extremely fine and there are feeble but distinct traces of raised ridges; legs rufescent, rather slender, except the femora, which are rather broad and compressed, posterior trochanters large; underside red.

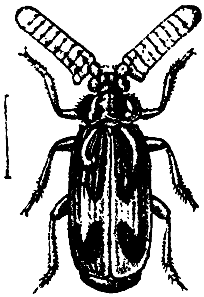
Fig. 204.—*Pleuropterus taprobanensis.*

Length 9–10 millim.

CEYLON; BOMBAY: Kanara.

According to Gestro this species is closely allied to *P. westermanni*, Westw. (Java), but more shining, with the sculpture of the head plainer, the antennæ narrower and more narrowed towards the apex, and the pronotum narrower with the sides less rounded and angled, as above described; the elytra are broader than the thorax, and the basal costa of the elytra is less abbreviated; the colour, moreover, is different, the black being more extended and the reddish colour deeper; several of these points, however, appear to be variable.

220. **Pleuropterus cardoni**, *Gestro.*

Pleuropterus cardoni, Gestro, Ann. Mus. Genova, 1901, p. 822, fig. 3; Wasmann, Notes Leyden Mus. xxv, 1904, p. 14.
Pleuropterus westermanni, Wasmann (*nec* Westwood), Notes Leyden Mus. xxv, 1904, p. 14, pl. i, fig. 4.

This species is very closely allied to the preceding, from which it may be known by its smaller size and the somewhat narrowly rounded, but not angular, sides of the pronotum, the greatest breadth being behind the middle and not in the middle as in

P. taprobanensis. From *P. westermanni* it may be distinguished by its smaller size, very shiny upper surface, and also by having the antennæ a little narrower, the anterior margin of the pronotum scarcely bisinuate, and the sides more narrowly rounded and more extended laterally; the basal costæ of the elytra are longer and are subparallel behind.

Length 7¾–8¼ millim.

BENGAL: Mandar (*Cardon*).

Subfamily PAUSSINÆ.

This subfamily contains the following genera:—*Ceratoderus*, Westw., *Merismoderus*, Westw., *Lebioderus*, Westw., *Platyrhopalus*, Westw. (from which Desneux has recently divided off *Euplatyrhopalus* and *Platyrhopalopsis*), *Paussomorphus*, Raffr., *Paussus*, L., and *Hylotorus*, Dalm. These are all represented in the Indian fauna, with the exception of *Lebioderus*, which contains five species, all confined to the Malay Region; *Paussomorphus*, containing a single species from Abyssinia; and *Hylotorus*, which is represented by three species from Africa. They are characterized by having the labial, and especially the maxillary, palpi short and thick and completely hiding the buccal cavity when they are laid against it in repose (fig. 205); the antennæ have from two to six joints, but in cases where there are more than two; the joints succeeding the first are more or less evidently soldered together, the shape of the antennal club is extremely variable.

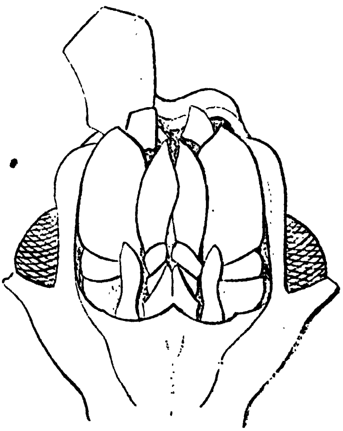

Fig. 205.—Head of *Paussus curtisi*, Westwood (Natal), viewed from the underside, with the mouth-parts closed (after Raffray).

Table of the Genera.

I. Second joint of the labial palpi always longer than broad, much longer than the preceding; maxillary palpi five-jointed.

i. Antennæ six-jointed, the last five joints more or less soldered together and forming a club.

1. Third joint of the maxillary palpi very large, but not widened at apex or compressed, subcylindrical CERATODERUS, Westw., [p. 454.

2. Third joint of the maxillary palpi very large, much widened at apex, and compressed .... MERISMODERUS, Westw., [p. 457.

ii. Antennæ two-jointed, the second joint forming a very distinct club.

1. Pronotum with the anterior portion or lobe twice as broad as the posterior and divided from it by a feeble furrow; club of antennæ irregular, strongly bidentate on its external margin .... EUPLATYRHOPALUS, Desn., [p. 465.

2. Pronotum not divided, with at most very feeble traces of a depressed transverse line in the middle.

A. Pronotum more or less cordiform, varying in relative length and breadth; club of antennæ round, lens-shaped, or oblong with the apex rounded and the base truncate .... PLATYRHOPALUS, Westw., [p. 458.

B. Pronotum very short, or short, transverse-oval .... PLATYRHOPALOPSIS, Desn., [p. 467.

II. First two joints of the labial palpi always very small and about equal; maxillary palpi four-jointed; antennæ two-jointed, the second forming a very variable club .... PAUSSUS, L., p. 469.

Genus CERATODERUS.

Ceratoderus, Westwood, Proc. Linn. Soc. Lond. xviii, 1842, p. 51; id., Arcan. Ent. ii, 1848, p. 37; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, p. 340.

Form rather slender and elongate; head large, produced before the eyes, which are small and not prominent, temples widely displayed behind the eyes; antennæ large, the first joint subquadrate, the rest soldered together and forming a broad flat club, 2–5 very transverse, of almost equal length, last joint longer, rounded at the apex; mandibles hooked and sharp, maxillæ with only one lobe, short, curved, and strongly bidentate at the apex; maxillary palpi large, but not much compressed, 5-jointed, with the third joint much the largest, somewhat ovate and thickened, and the

last two much shorter, narrower and gradually tapering; labial palpi 3-jointed, subclavate, with the last joint considerably the largest; pronotum very slightly broader than the head, elongate, much narrowed behind, with a strong transverse furrow behind the middle and a much feebler longitudinal furrow; elytra rather long; pygidium uncovered; legs rather robust, compressed, tarsi somewhat elongate, the last joint considerably longer than the others.

Range. This genus comprises three species, all of which belong to the Indian region.

Key to the Species.

I. Head black; external outline of club of antennæ even.
  1. Club of antennæ longer and narrower, and more narrowed towards base, with the apex black or fuscous .... *bifasciatus*, Koll., p. 455.
  2. Club of antennæ shorter and broader, and less narrowed towards base, unicolorous .... *oberthuri*, Gestro, p. 456.

II. Head ferruginous or reddish castaneous; external outline of club uneven. *andrewesi*, Desneux, p. 456.

221. **Ceratoderus bifasciatus,** *Koll.*

Paussus bifasciatus, Kollar, Ann. Hofmus. Wien, i, 1836, pl. 31, fig. 7; Westwood, Trans. Ent. Soc. Lond. ii, 1839, p. 91, pl. 10, fig. 3.

Ceratoderus bifasciatus, Westwood, Arcan. Ent. ii, 1845, p. 37, pl. 58, fig. 1; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, pl. 15, fig. 6, & pl. 17, figs. 22-24; Wasmann, Deutsche Ent. Zeitschr. 1895, p. 44.

A small, rather narrow, elegant species, very shiny, yellow or reddish yellow, with the apex of the antennæ fuscous, and with the head, a broad band stretching right across the elytra from near the apex to beyond the middle, and the legs, for the most part, black; head channelled and punctured in front and more or less distinctly impressed on the vertex; pronotum long, cordiform, plainly longer than broad, constricted and sulcate behind the middle, smooth and shining; elytra broader than the anterior part of the pronotum, with the shoulders rounded, truncate at the apex, the disc scarcely visibly sculptured; legs black or pitchy-red, with the tarsi reddish; underside red or yellow.

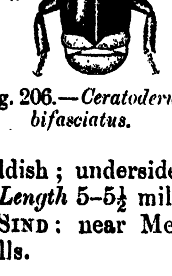

Fig. 206.—*Ceratoderus bifasciatus.*

Length 5–5½ millim.

Sind: near Mehidpur; **Bengal**: Dacca; **Madras**: Nilgiri Hills.

222. Ceratoderus oberthuri, *Gestro.*

Ceratoderus oberthuri, Gestro, Ann. Mus. Genova, xl, p. 901.

Of a testaceous-ferruginous colour, with the head black, and with a broad black band reaching from near the apex to beyond the middle, the black colour at the apex being not sharply defined, but encroaching somewhat on the lighter colour at the extreme apex. The species is closely allied to *C. bifasciatus*, but differs in having the club of the antennæ shorter and broader and less narrowed towards the base, and it may be at once known by the club and the legs being of a unicolorous testaceous, or reddish testaceous, colour; the average size appears to be a little smaller.

Length 4⅔-5 millim.

BOMBAY: Bombay (*Downes*), Bandra (*Jayakar*).

223. Ceratoderus andrewesi, *Desn.*

Ceratoderus andrewesi, Desneux, Ann. Soc. Ent. Belgique, xlix, 1905, p. 194.

Of about the same size as the preceding, but very distinct both in form, colour, and sculpture; of a ferruginous or dark castaneous red colour, with the elytra black, except a broad band at the shoulders and the extreme apex; head large, impressed, granulose; antennæ entirely ferruginous, first joint comparatively long, 2-6 forming a broad flat club, with the outline much more irregular than in *C. bifasciatus*, the second joint being very short and produced externally into a short blunt point, and the next three only slightly projecting externally, the apical joint being longer and rounded; pronotum much longer than broad, divided behind the middle by a strong furrow, which is continued upwards at the sides and makes the anterior angles appear raised and somewhat prominent; the excavation is furnished with short yellow pilose pubescence; the anterior part is very strongly channelled and raised on each side and is diffusely and rather strongly punctured; the hinder portion is also channelled deeply in front; elytra oblong, parallel-sided, with diffuse and comparatively strong punctuation, each puncture bearing a small yellow seta; legs moderate, with the tarsi rather long, ferruginous, the femora and part of the tibiæ darker; underside mostly ferruginous.

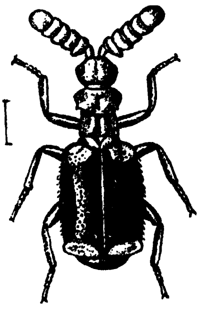

Fig. 207.—*Ceratoderus andrewesi.*

Length 5 millim.

MADRAS: Nilgiri Hills (*H. L. Andrewes*), south end of Lake Chilka, 3.iii.1910 (*Annandale*, Indian Museum).

Type in coll. Andrewes.

I am much obliged to Mr. H. E. Andrewes for the loan of the type of this pretty and very distinct species.

Genus **MERISMODERUS.**

Ceratoderus, subg. *Merismoderus*, Westwood, Trans. Ent. Soc. Lond. v, 1847, p. 23.
Merismoderus, Lacordaire, Gen. Col. ii, 1854, p. 11; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, p. 341.

Somewhat elongate, and a little compressed; head variable, eyes very small; antennæ formed apparently of six joints, of which the first is comparatively large, and the remaining five, though apparently distinct, are soldered together; maxillæ with two lobes, the inner large and bifid at the apex, the outer very small; maxillary palpi large and compressed, the third joint being broad and dilated and much larger than all the rest together; the first two joints are very small, and the last two small, narrow, cylindrical, and curved, the last being truncate at the apex; labial palpi three-jointed, the first joint very small, the second and third large, about equal, dilated apically, the apex of the last joint broad, subtruncate, and slightly excavate; pronotum deeply divided and bilobed, with the anterior angles produced at the sides; elytra almost rectangular, with strong traces of raised lines; legs comparatively long and slender.

This genus contains two species, *M. bensoni*, Westw., from India, and *M. hamaticornis*, Van der Poll, from Sumatra; the latter species has the head short and strongly transverse, while in the former it is large and subquadrate. The genus is closely allied to *Ceratoderus*, of which Westwood regarded it at first as a subgenus. If the clubs of the antennæ are to be regarded as solid, both genera might be assigned to *Paussus* proper, to certain species of which *M. bensoni* is closely allied in the form of the pronotum etc.; the transverse impressions across the club of the antennæ in certain species of *Paussus*, e.g. *P. schiodti* and *P. hearseyanus*, appear to indicate the original sutures between the now fused joints.

224. **Merismoderus bensoni**, *Westw.*

Merismoderus bensoni, Westwood, Trans. Ent. Soc. Lond. v, p. 23, pl. ii, fig. 2; id., Thes. Ent. Oxon. p. 80, pl. 18, fig. 1; Benson, Calcutta Journ. Nat. Hist. vi, pp. 466–470; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, pl. 17, figs. 25-27.

Of a luteous yellow colour, dull; head large, produced before the eyes, which are small and not prominent, impressed or channelled in front, and with an impression on each side between the eyes; these are somewhat variable; antennæ rather long, with the club moderately broad, somewhat narrowed towards the base; pronotum bilobed, the deep dividing furrow being more or less plainly furnished with yellow pubescence, anterior portion longitudinally channelled, with the anterior angles somewhat acutely produced on each side; elytra very finely sculptured, coriaceous, with a large, more or less irregular, shining black spot on each at the sides, not touching the suture, reaching from a little before the apex to about the middle, and with a small common or divided black spot at the apical sutural angle; sides finely setose; legs yellow.

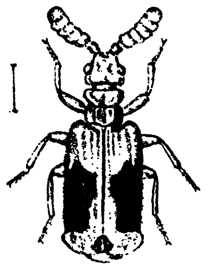

Fig. 208.
Merismoderus bensoni.

Length 6 millim.

United Provinces: Cawnpur, near Saharunpur (*Benson*).

Benson's original record is as follows:—"I took two specimens, under a brick, near the river Ganges, about fifty miles below Cawnpore, last year (1844), and this year (1845) I took one under a stone, in a black ants' nest between the Savalik Range and Saharumpore."

Genus **PLATYRHOPALUS.**

Platyrhopalus, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 654; id., Arcan. Ent. ii, 1845, p. 73; Raffray, Nouv. Arch. Mus. Paris, (2) viii, 1885, p. 344.

Form somewhat elongate, oblong, robust; head rather large, eyes large, with the temples apparent behind them; antennæ two-jointed, with a large elliptical, almost circular, or oblong club, which is more or less incised externally at the base, the incision forming a more or less pronounced tooth; maxillæ large, bilobed, the inner lobe hooked, the outer styliform; maxillary palpi five-jointed, with the third joint large and thick, and the rest small; labial palpi three-jointed, the first joint small, the second large and cylindrical, and the last smaller than the preceding; pronotum more or less plainly cordiform, transverse, or as broad as long, much narrower at the base than the elytra; elytra oblong, parallel-sided, more or less depressed, with the shoulders not strongly prominent; legs rather short, compressed, with the apical angle of the tibiæ sharply produced, femora in part excavate to receive the tibiæ, tarsi comparatively short.

Range. One African species is known; the rest are all from the Indian and Indo-Malayan regions, eight of these occurring in India.

Key to the Species.

I. Club of antennæ elliptical or almost circular, not or scarcely longer than broad.
  i. Pronotum strongly transverse, much constricted behind middle.
    1. Size larger (9 mm.); form narrower; elytra with the marginal setæ short .... *denticornis*, Don., p. 459.

2. Size smaller (6 mm.); form broader; elytra with the marginal setæ long .... *cardoni*, Wasm., p. 460.

ii. Pronotum less strongly transverse, much constricted behind middle.

1. Size larger; form oblong, broader; pronotum broader .... *westwoodi*, Saund., p. 462.

2. Size smaller; form subcylindrical, narrower; pronotum narrower .. *paussoides*, Wasm., p. 463.

iii. Pronotum not transverse, at least as long as broad, only slightly constricted behind middle.

1. Margins of club of the antennæ even .... *angustus*, Westw., p. 461.

2. Margins of the club of the antennæ uneven .... *intermedius*, Bens., p. 462.

II. Club of antennæ oblong, rounded at apex and truncate at base, twice as long as broad.

i. Size larger (9 mm.); elytra with at most two or three minute or more or less obsolete reddish yellow spots behind the middle .... *mandersi*, sp. n., p. 464.

ii. Size smaller (7 mm.); elytra with a large, dentate, irregular yellowish ferruginous transverse band on each before the apex, meeting at the suture .... *comotti*, Gestro, p. 464.

225. Platyrhopalus denticornis, *Don.*

Paussus denticornis, Donovan, Ins. Ind. i, 1800, p. 8, pl. 5, fig. 1.

Platyrhopalus denticornis, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 657, pl. 33, figs. 43-48; id., Arcan. Ent. ii, 1845, p. 77, pl. 68, fig. 1; Burmeister, Mag. Zool. 1841, Ins. pl. 76, fig. 2; Lacordaire, Gen. Col. Atlas, pl. 14, fig. 3; Wasmann, Notes Leyden Mus. xxv, 1904, p. 19, pl. 3, fig. 2.

Var. *Platyrhopalus unicolor*, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 659, pl. 33, fig. 49; id., Arcan. Ent. ii, 1845, p. 79, pl. 68, fig. 4.

Colour variable, rufo-castaneous, the elytra dark, with a more or less broad longitudinal patch on each side of the suture, usually, but not always reaching the base, and with a smaller patch behind the middle, and all the margins rufous or rufo-castaneous, or rufo-castaneous with obscure darker markings on the elytra, or entirely rufo-castaneous; head broader than long, with the eyes prominent, more or less distinctly channelled; antennæ with the first joint broad and stout and the second broadly oval, the length and breadth being about equal, convex above and below, the margins compressed and acute, base above with a transverse impression ending in a small incision which leaves on the side nearest the first joint a small, distinct, but not sharp tooth, which is rounded at its apex; pronotum distinctly transverse, subcordiform, with the sides strongly rounded in front and contracted abruptly behind into a short collum or neck, before which there is a more or less distinct impression; sides set with short setæ; upper surface rather shining, sculpture fine and variable but sometimes distinct; elytra rather long, oblong, very finely sculptured, much broader than the pronotum, depressed at the base and with the shoulders prominent, sides set with distinct short yellowish setæ; legs comparatively short, stout, with the tibiæ dilated and compressed, their external angles, especially in the case of the posterior pair, sharply produced, with two spurs; underside rufo-castaneous.

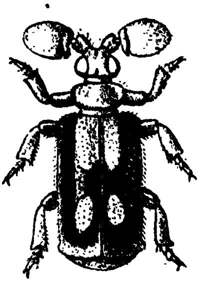

Fig. 209.
Platyrhopalus denticornis.

Length 7½–10 millim.

Bengal: Calcutta; Bombay: Wallon near Ahmednagar, Khandala.

The specimens from Wallon were found in nests of *Pheidole latinoda*, Rog.

Var. **unicolor**, *Westw.*

Differs from the type-form in being of a unicolorous brownish castaneous colour, and in having an abbreviated transverse stria across the pronotum.

Length 9 millim.

India (no locality given).

According to Westwood *P. unicolor* differs from *P. denticornis* in its uniform colour, in having the front of the head apparently rounded, in the suddenly coarctate base of the pronotum (this, however, is a strongly marked character of *P. denticornis*), and in the short transverse median stria of the same; the characters are not, however, sufficiently marked to separate it specifically.

226. **Platyrhopalus cardoni**, *Wasm.*

Platyrhopalus cardoni, Wasmann, Notes Leyden Mus. xxv, 1904, p. 19.

Resembling *P. denticornis*, but smaller and relatively broader, rufo-castaneous, with a longitudinal dark stripe on each elytron, which stripes are united in the middle by a transverse band. The club of the antennæ is larger and broader than in *P. denticornis*, scarcely longer than broad, and with much longer setæ; pronotum shorter, twice as broad as long, but still cordiform; the elytra at the sides are furnished with long setæ, which are much longer than in *P. denticornis*.

Length 6 millim.

Bengal: Chota Nagpur (*Cardon*).

The species in some respects approaches *Platyrhopalopsis mellyi* and *picteti*, but is much smaller and differently coloured, and the pronotum is subcordiform and not elliptical as in these species.

227. **Platyrhopalus angustus**, *Westw.*

Platyrhopalus angustus, Westwood, Trans. Ent. Soc. Lond. ii, 1839, p. 92, pl. 10, fig. 6; id., Arcan. Ent. ii, 1845, p. 79, pl. 68, fig. 3.

Platyrhopalus suturalis, Westwood, Arcan. Ent. ii, 1845, pp. 161 & 190, pl. 88, fig. 1 *a*.

Var. *Platyrhopalus acutidens*, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 651, pl. 33, fig. 60; id., Arcan. Ent. ii, p. 79.

Platyrhopalus angustus, var. *major*, Wasmann, Notes Leyden Mus. xxv, 1904, p. 20.

Rufo-castaneous, rather shining, with a single large triangular dark patch on the side of each elytron, the base of which almost rests on the margins; head not, or scarcely channelled in front; antennæ with the first joint large, subquadrate, produced internally into a strong blunt tooth, the second joint forming a large, convex, shining, almost circular club, with even margins, which is impressed just before the base where there is a wide incision, one side of which is formed by a long sharp tooth; pronotum at least as long as broad and not very abruptly contracted behind the middle, very finely sculptured; elytra oblong, extremely finely sculptured, subparallel-sided, slightly widened behind; tibiæ dilated and compressed, and ending in a sharp point externally at the apex.

Length 6–7½ millim.

Central India: Nimach.

This species may at once be known from *P. denticornis* (apart from colour, which is often variable in the different species) by the wider incision and much longer and sharper tooth of the club of the antennæ, and the less transverse pronotum; the sculpture on the latter is finer, and the contraction behind the middle much less abrupt.

Var. **acutidens**, *Westw.*

Larger, broader, and less parallel-sided than the type-form, with the tooth at the base of the club of the antennæ longer, sharper, and almost falcate.

Length 7–8 millim.

Nepal.

Var. **major**, *Wasm.*

Larger than the type, of a bright castaneous colour, with a dark transverse band on the elytra, which is interrupted at the suture.

Length 8½–9 millim.

Sind.

Westwood (*l. c.*) proposed his name *P. acutidens* for an imperfect specimen without elytra, legs, or abdomen. This specimen is at present in the British Museum, as the type of the species, with the body and the elytra of a species of the phytophagous genus *Lema* (of the same colour as the front parts, but strongly punctured) appended to the pronotum to make up a perfect insect! The single type of *P. angustus* is badly set and not in good condition. It is very probable that var. *acutidens* and var. *major* are the same insect, but I have not seen a specimen of the latter: the characters of the club, as compared with *P. denticornis*, are very distinct.

In the Indian Museum there is a dark variety from Bengal, Purneah District, and a varying series from the following localities:—

MADRAS: Dumagudiem, Godavari; BENGAL: Purneah District; UNITED PROVINCES: Chandan Chowki, Dehra Dun; KASHMIR: Jhelum Valley; ASSAM: Dunsiri Valley.

228. Platyrhopalus intermedius, *Bens.*

Platyrhopalus intermedius, Benson, Calcutta Journ. Nat. Hist. vi, 1846, p. 468; Westwood, Trans. Ent. Soc. Lond. v, 1847, p. 25.

Rufo-castaneous, with the elytra rather narrow, each with an elongate irregular triangular patch at the sides; antennæ with a moderate-sized, somewhat roundly-quadrate club, with the posterior margin undulated, broadly incised at the base, with the projecting tooth sharp; the clypeus is not, or very slightly emarginate, and the tibiæ are broad and obliquely truncate.

This species appears to have the incision and tooth of the club of *P. angustus*, and the uneven margin of the club of the antennæ of *P. westwoodi*; the coloration of the elytra is different from that of the latter.

Length 7½–9 millim.

UNITED PROVINCES: Saharunpur (*Benson*).

It is very probable that this is a form of *P. angustus*.

229. Platyrhopalus westwoodi, *Saund.*

Platyrhopalus westwoodi, Saunders, Trans. Ent. Soc. Lond. ii, 1835, p. 84, pl. 10, fig. 5; Westwood, Trans. Linn. Soc. Lond. xix, 1842, p. 51; id., Arcan. Ent. ii, 1845, p. 78, pl. 68, fig. 2.

Slightly smaller, on an average, than *P. denticornis*, and distinguished from it by the wider incision and much sharper tooth at the base of the club of the antennæ, by the longer pronotum, and by the colour of the elytra, which seems fairly constant, being rufo-castaneous with a common dark patch, usually more or less triangular, at the base, a large patch at the side of each, diminishing in length towards the suture and not meeting, and a large and more or less irregular patch at the apex meeting at the suture. From *P. angustus*, which it resembles in some respects, it may be known by the irregular edge of the club of the antennæ and the shorter tooth at the incision, and by the colour of the elytra. The pronotum is somewhat variable in length, but is about as long as broad, not strongly contracted behind, and has three impressed lines, which are often more or less obsolete; the pygidium is black and shining; the tibiæ are somewhat emarginate before the apex and terminate xternally in a sharp tooth.

Length 8 millim.

ASSAM: Patkai Hills, Manipur; BURMA.

230. Platyrhopalus paussoides, *Wasm.*

Platyrhopalus paussoides, Wasmann, Notes Leyden Mus. xxv, 1904, p. 20, pl. 3, fig. 3.

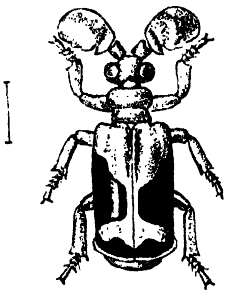

Fig. 210.—*Platyrhopalus paussoides*, var.

A comparatively small species, closely resembling in general appearance certain species of *Paussus*; narrow, subcylindrical, shining, of a dark castaneous colour, with the elytra black except for a narrow rufo-testaceous basal spot on each near the suture (which is black), and a common transverse band or spot some little way before the apex, the suture between these being castaneous, but the pale basal markings are sometimes greatly extended; head flat and smooth between the eyes, which are large and prominent; clypeus truncate and not emarginate, furnished with a short and very thin longitudinal line; club of the antennæ about as long as broad, almost round and very convex, with the margins acute and with the posterior or external margin deeply and broadly sulcate and incised, and furnished with a sharp basal tooth; pronotum with rufous setæ at the sides, subcordiform, not transverse, only a little narrower at the base than at the apex, gently constricted before the apex, with a transverse line; elytra oblong, parallel-sided, very finely alutaceous, and finely but distinctly punctured and rather closely pubescent (in fresh specimens); legs pitchy, narrower than in *P. angustus*.

Length 6½–7½ millim.

BHUTAN; UNITED PROVINCES: Dehra Dun; ASSAM: Goalpara (*Iver*).

The longer pronotum will at once separate the species from *P. denticornis*, and the (as a rule) darker colour, narrower form, uneven margins of club, etc. will distinguish it from *P. angustus*, to which it is most nearly allied.

231. Platyrhopalus mandersi, sp. n.

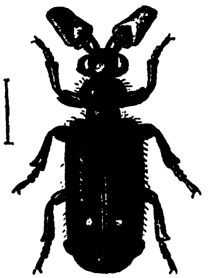

Fig. 211.—*Platyrhopalus mandersi.*

Elongate, oblong, shining, pitchy black, practically unicolorous, with fine setæ at the sides; there are traces of small reddish yellow spots behind the middle, and the suture is sometimes very narrowly reddish; head short and broad, with the eyes large and prominent occupying the whole of its sides; antennæ with the first joint large and quadrangular, produced into a blunt tooth just above the insertion of the club, which is oblong, twice as long as broad, slightly narrowed towards the apex which is rounded, truncate and strongly impressed longitudinally at the base, with the exterior angle slightly notched, forming two very short broad blunt teeth, margins all carinate, underside distinctly convex and raised in the middle into a broad point, if viewed from the side; pronotum cordiform, about as long as broad, with the sides strongly rounded in front, then contracted abruptly and gradually widened to the base; elytra very long, parallel-sided, very shining, extremely finely and scarcely visibly punctured; pygidium dull, very finely sculptured; legs stout, tibiæ with the apical angles sharply produced, femora grooved to receive tibiæ, tarsi rather long, onychium nearly as long as the other joints together; trochanters of posterior tibiæ large; underside of abdomen smooth; the fine lateral setæ are thickest at and just behind the shoulders.

Length 9 millim.

BURMA: Shan States (*Manders*).

Type in the British Museum.

This fine and distinct species forms a separate section of the genus with *P. comotti*, Gestro, being distinguished from all the other species by its elongate, oblong club. From *P. comotti* it may be easily separated by its considerably larger size and by the absence of the transverse, irregularly dentate patch towards the apex of each elytron, which is characteristic of the last-named species; the exterior angle of the club, moreover, is more acutely dentate in *P. comotti*, and the elytra are proportionally shorter and broader with the shoulders more markedly produced.

It is possible that these two species may have generic value.

232. Platyrhopalus comotti, *Gestro.*

Platyrhopalus comotti, Gestro, Ann. Mus. Genova, xviii, 1882, p. 311.

Pitchy black, shining, with the anterior and posterior margins of the elytra rufo-castaneous; elytra with the suture narrowly, the posterior margin, and a transverse, irregularly dentate patch on each a little before the apex (meeting at the suture), yellowish ferruginous; head moderately large, antennæ with the first joint somewhat long proportionally, and the club elongate, about twice as long as broad, with the sides subparallel and the base obliquely truncate; the apex and the internal basal angle are rounded, and the external basal angle is excised and sharply produced and denticulate; the whole margins of the club are acute, and the upper side is moderately and the underside more convex, while the base is depressed and excavate on its upper side, the whole surface except the broad excavation being very finely granulose and villose; pronotum cordiform, a little widened at the base, not transverse; elytra rather long and parallel-sided, with the shoulders somewhat strongly produced and more thickly set with short setæ than the sides; legs moderate, tibiæ sharply produced externally at the apex; underside reddish castaneous.

Length 7 millim.

BURMA (*Captain Comotto*).

Genus EUPLATYRHOPALUS.

Euplatyrhopalus, Desneux, Genera Insectorum (Wytsman), Paussidæ, 1905, p. 18.

Platyrhopalus, Westwood (*ex parte*), Trans. Linn. Soc. Lond. xvi, p. 654, *et auctt.*

Form elongate-oblong, depressed; head transverse, considerably narrower than the pronotum; eyes large and prominent, but not occupying the whole of the sides, as the temples are visible behind them and project a little on either side; antennæ two-jointed, the first subquadrate, the second large, flat and irregular, the inner margin being simple and the outer margin very deeply cut out, leaving two large and long sharp teeth; maxillary palpi large, 4-jointed, with the first joint small, the second very large and produced internally at the apex into a more or less distinct tooth, and the third and fourth very small, the latter being more or less pointed at its apex; labial palpi rather large, with the first joint very small and the two others much longer, cylindrical, the third being acuminate; pronotum large, transverse, bilobed but not divided, the anterior portion crescent-shaped, with the posterior angles produced, the posterior portion forming a short neck; elytra somewhat long, with the shoulders prominent and extended towards the posterior angles of the anterior part of the pronotum; legs rather long and slender, apex of tibiæ produced externally into a sharp point, internally furnished with spurs; tarsi moderately large.

Range. India, Sumatra, and Java.

It seems strange that the species forming this genus should so long have been left under *Platyrhopalus*, for they differ from the genus in several important respects, and agree (both superficially and otherwise) much more closely with *Lebioderus*. Four species have been described, two of which occur in the Indian Region, one in Sumatra, and one in Java.

Key to the Species.

I. Club of the antennæ smaller, with the apex rounded; inner margin with two large and sharp teeth in the middle....	*aplustrifer*, Westw., p. 466.
II. Club of the antennæ larger, with the apex produced into a sharp point; inner margin with two very large teeth in the centre (longer than in the preceding species)	*vexillifer*, Westw., p. 466.

233. Euplatyrhopalus aplustrifer, *Westw.*

Platyrhopalus aplustrifer, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 664, pl. 33, fig. 51: id., Arcan. Ent. ii, p. 163, pl. 88, fig. 3; Wasmann, Notes Leyden Mus. xxv, pp. 21 & 22, fig. *a*.

Of a bright castaneous colour, lighter or darker, shining; head smooth, with a few large punctures; antennæ with the first joint rather large, oblong or subquadrate, second joint forming a broad toothed club, as above described; pronotum with diffuse and rather distinct punctuation in the centre; elytra long, parallel-sided, very finely sculptured, with feeble traces of raised lines; follicles (or small sac-like processes) at sides of apex small but distinct; underside castaneous.

Length 6½–7½ millim.

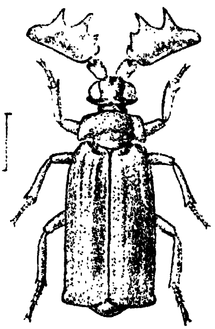

Fig. 212.—*Euplatyrhopalus aplustrifer*.

Bengal: Netrakona, Chota Nagpur, Barway; Bombay: Kanara (Indian Museum).

The species is apparently not very uncommon, and widely distributed.

234. Euplatyrhopalus vexillifer, *Westw.*

Platyrhopalus vexillifer, Westwood, Thes. Ent. Oxon. 1874, p. 82, pl. 17, fig. 4; Wasman, Notes Leyden Mus. xxv, 1904, p. 21, pl. 3, fig. 4.

On an average larger than the preceding, to which it is very closely allied by the shape of the club, which, as above described, is larger, with larger and sharper central teeth, and has the apex sharply produced instead of rounded off; the colour, moreover, is pitchy, the antennæ and body are less depressed, and the head has an oval depression between the front of the eyes; according to Westwood the femora have a peculiar character on their inner surface, consisting of a small group of ridges arranged in a radiating manner: these are probably sexual, and look like a stridulating organ; legs moderate, pitchy.

Length 7–8½ millim.

BHUTAN; PENANG.

Genus PLATYRHOPALOPSIS.

Platyrhopalopsis, Desneux, Gen. Insect. (Wytsman), Paussidæ, 1905, p. 20.

Platyrhopalus, Westwood (*ex parte*), Trans. Linn. Soc. Lond. xvi, 1838, p. 685.

Form very broad, short, more or less convex and thick-set; head small, broader than long, very much narrower than the pronotum; eyes large and prominent, with the temples visible behind, but occupying the greater part of the sides of the head; antennæ two-jointed, with the first joint somewhat long and extended beyond the insertion of the club, which is very large, flat, and almost circular, slightly concave above, very slightly convex below, and not emarginate and dentate at the base; the maxillæ and maxillary palpi are much as in *Platyrhopalus*, but the labial palpi have the second joint longer in proportion; pronotum short, or very short, and broad, transversely elliptical; elytra very broad, broadly oblong or almost square, with the shoulders rounded and not prominent; legs very short, broad and compressed, femora deeply furrowed underneath to receive the tibiæ; tarsi short, with the last joint about as long as the others together.

The only genus that at all approaches this in form is *Cerapterus*, which may at once be known by its 10-jointed and quite differently shaped antennæ; it is very closely allied to *Platyrhopalus*, and the chief difference appears to lie in the shape of the pronotum and the general form. The characters given by Desneux with regard to the second joint of the labial palpi and the shape of the antennæ are not worth much, as *Platyrhopalus* varies somewhat in these respects; the strong femoral grooves, at first sight, appear to offer a good distinction, but these are present, although to a less degree, in *Platyrhopalus*. The discovery of a somewhat intermediate species, described below, complicates matters, but it must, I think, be certainly referred to this genus.

Key to the Species.

1. Form shorter and more convex; elytra unicolorous.
   i. Pronotum with the sides broadly angulated; margin of antennal club notched .... *mellyi*, Westw., p. 468.

ii. Pronotum with the sides completely rounded; margin of antennal club entire .... *picteti*, Westw., p. 468.
II. Form somewhat longer and less convex; elytra with a common small V-shaped reddish-yellow patch at the suture, behind the middle .... *badgleyi*, sp. n., p. 469.

235. Platyrhopalopsis mellyi, *Westw.*

Platyrhopalus mellyi, Westwood, Trans. Ent. Soc. ii, p. 84, pl. 10, fig. 5; id., Thes. Ent. Oxon. 1874, pl. 18, fig. 2; Wasmann, Notes Leyden Mus. xxv, 1904, p. 18.
Platyrhopalopsis mellyi, Desneux, Gen. Insect., Paussidæ, pl. 2, fig. 20.

Stout and robust, pitchy or pitchy-black, unicolorous, shining: head almost smooth, with feeble traces of a central furrow on the vertex; club of antennæ almost round, with the apical part of the external margin uneven, with two or three moderate notches, the produced parts being clothed with short hairs; pronotum very small and very transverse, the sides being broadly angulate and the posterior portion depressed and divided off by a slightly raised ridge; elytra very broad, smooth, very finely sculptured and pubescent; underside and legs pitchy or reddish-pitchy.

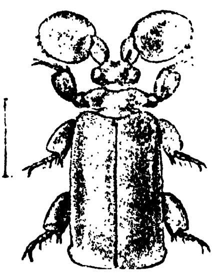

Fig. 213.
Platyrhopalopsis mellyi.

Length 9½–10½ millim.

NORTHERN INDIA: generally distributed; BOMBAY: Belgaum, Kanara; MADRAS: Nilgiri Hills, Madura, Cochin.

I feel very doubtful whether this species is really distinct from *P. picteti*, as the question of sex does not appear to have been cleared up.

236. Platyrhopalopsis picteti, *Westw.*

Platyrhopalus picteti, Westwood, Thes. Ent. Oxon. 1874, p. 82, pl. 18, fig. 3, *a–c*; Wasmann, Notes Leyden Mus. xxv, 1904, p. 18.

Closely allied to the preceding, and distinguished by having the club of the antennæ entire along its whole margin, and the margin throughout its length finely setose; the basal joint of the antennæ is narrower and more acute at the tip; the pronotum has the lateral margins rounded and not angulated, and the basal portion not distinctly divided off by a ridge; the middle and hind tibiæ have the outer apical angle acute and extended backwards.

Length 9½–10½ millim.

BURMA: Pegu; NORTHERN CHINA: widely distributed (*teste* Wasmann); SIAM; COCHIN CHINA.

Westwood (*l. c.* p. 82) believed it possible that the above distinctions might be sexual; but the two species are still considered distinct by Wasmann, Desneux, and other recent writers. Their ant-host has not yet been discovered.

237. Platyrhopalopsis badgleyi, sp. n.

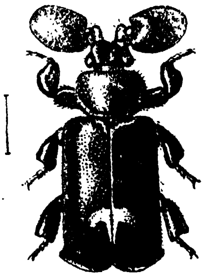

Fig. 214.—*Platyrhopalopsis badgleyi.*

A very distinct, broad, rather shining species, not so small and polished as the preceding, and with the elytra more oblong and less convex, distinctly but finely punctured, and with a small curved yellowish-red patch on each behind the middle and meeting at the suture, forming a V-shaped patch with the arms recurved, and the point directed towards the apex of the elytra: these patches are, apparently, sometimes divided or obsolete; the head is rather longer than in the preceding, and the club of the antennæ is less circular; the pronotum is very transverse, but longer than in *P. mellyi*, oval, with the sides rounded, and with faint traces of a depression in the middle; the elytra form an almost perfect broad rectangular figure, and, although convex as a whole, they are depressed on the disc; the sides of the pronotum and the elytra are thickly set with short yellow setæ; the club of the antennæ and the disc of the pronotum are also pubescent, and towards the apex of one of the elytra of one of the three specimens known, and at the side of another there are patches of rather scanty but very long delicate greyish-yellow pubescence, which probably clothes most of their surface in fresh specimens; legs stout, compressed, pitchy, in part ferruginous; underside ferruginous, finely sculptured and pubescent.

Length 10-10½ millim.

ASSAM (*Badgley*).

Type in the British Museum.

Described from three specimens.

Genus PAUSSUS.

Paussus, Linné, Bigæ Insect. 1775, p. 7; Westwood, Arcan. Ent. ii, 1845, p. 164; id., Thes. Ent. Oxon. 1874, p. 82; Raffray, Nouv Arch. Mus. Paris, (2) viii, 1885, p. 346; Desneux, Gen. Insect., Paussidæ, 1905.

This genus is by far the richest in species, and is composed of extremely variable forms. Its members may be known superficially from almost all the rest by the two-jointed antennæ, the second joint of which is expanded into a very variable club, coupled with the fact that the pronotum is always divided into two lobes by a more or less distinct transverse furrow, which, in most instances, is very deep, and is often furnished with tufts of yellow secretory hairs at the sides. The only other genera which resemble it in these respects are: *Hylotorus*, which, however, has very minute antennæ and quite a different facies; *Lebioderus*, which has the club of the antennæ practically composed of five joints soldered together; and *Euplatyrhopalus*, in which the transverse furrow of the pronotum is only slightly marked. The only fixed characters which serve definitely to distinguish the genus are as follows:—Maxillary palpi always composed of four joints, with the second always considerably larger than the adjacent, variable, sometimes (e. g., *P. cultratus*) normal and scarcely as long as the two apical joints, often very long and strongly dilated, followed by two minute apical joints; labial palpi three-jointed, with the first two always small and the third very long, variable in shape and size, and more or less acuminate at the apex.

The forms assumed by the club of the antennæ are most extraordinary and bizarre. In the Indian species it is mostly either long or lens-shaped, without excavation, or boat- or cornucopia-shaped, with a strong exterior excavation, which has the lower margin at least denticulate or scalloped, and with or without setæ. One or two forms occur with a long cylindrical club (e. g., *P. jousselini*), but there is nothing like the extraordinary Madagascar species, *P. elephas* and *P. dama*, or the Abyssinian *P. crenaticornis*.

The species with the club excavate might well be placed in a separate genus, but intermediate forms occur. There can be no question that the genus requires subdivision, as it is very unwieldy at present; but this must be undertaken by a monographer of the whole of the species. The number described at present is about 180, and this probably represents a comparatively small proportion, as they are, in most instances, very scarce, and many of the regions in which they occur have been very little worked for the smaller Coleoptera; the PAUSSIDÆ, moreover, from their peculiar habits, require special methods of working.

The species are widely distributed throughout Africa (so far as at present known) and the warmer parts of Asia; two, *P. favieri* and *P. turcicus*, occur in Europe, the former being fairly common locally in Spain and on the opposite African coast, and the latter being found in Greece, Turkey, and Asia Minor; one or two have been described from Australia, but the genus *Arthropterus* apparently takes the place of *Paussus* in that country. No species has yet been recorded from North or South America.

Key to the Species.

- I. Club of antennæ not excavate. (*Paussus*, i. sp.)
  - i. Club of antennæ not cylindrical, with or without transverse impressions or furrows on its exterior disc.
    - 1. Pronotum with a central transverse furrow, but not distinctly divided into an anterior and posterior portion.
      - A. Head very large, much produced and rounded before the eyes; club of antennæ broad and flat, bean-shaped .... *desneuxi*, sp. n., p. 475.
      - B. Head not strongly produced before the eyes, transverse or subtriangular; club of antennæ a little longer than broad.
        - *a*. Club of antennæ more or less round, lenticular.
          - *a**. Club of antennæ without, or only with traces of transverse impressions.
            - *a*†. Posterior margin of club with a long ovate impression in the middle .... *spencei*, Westw., p. 476.
            - *b*†. Posterior margin of club without an elongate impression.
              - *a*‡. Anterior portion of pronotum not impressed on each side, smooth and shining .... *affinis*, Westw., p. 476.
              - *b*‡. Anterior portion of pronotum impressed on each side, rather dull .... *cognatus*, Westw., [p. 477.
          - *b**. Club of antennæ with three strong entire transverse impressions .... *hearseyanus*, Westw , [p. 478.
          - *c**. Club of antennæ with two strong transverse impressions, and a third abbreviated ...... *horni*, Wasm., p. 479.
          - *d**. Club of antennæ with one strong transverse impression, and a second more or less abbreviated .... *sesquisulcatus*, Wasm., [p. 480.
        - *b*. Club of antennæ distinctly oblong, longer than broad.
          - *a**. Club of antennæ with four strong distinct transverse impressions .... *schiodtei*, Westw., [p. 478.
          - *b**. Club of antennæ without transverse impressions ...... *adamsoni*, sp. n., p. 481.

2. Pronotum strongly divided into an anterior and posterior portion.

A. Elytra with strong short equidistant tufts of stiff setæ at the sides; club of antennæ subovate, lenticular or lens-shaped, impressed but not excavate .... *rufitarsis*, Westw., [p. 481.

B. Elytra without special tufts of setæ at the margins.

a. Club of antennæ inverted pear-shaped. Size small: length 4 millim. .... *pilicornis*, Don., p. 482.

b. Club of antennæ oblong bean-shaped. Size larger: length 6½ millim.................... *fletcheri*, sp. n., p. 483.

ii. Club of antennæ long and narrow, cylindrical or subcylindrical.

1. Club of antennæ without minute teeth at the apex, subcylindrical; head not strongly produced before the eyes.

A. Club of antennæ less elongate and parallel-sided, outer side somewhat rounded; colour unicolorous fulvo-castaneous .... *saundersi*, Westw., [p. 483.

B. Club of antennæ more elongate, parallel-sided, outer side almost as straight as the inner; elytra with the disk black .... *hardwicki*, Westw., [p. 484.

2. Club of antennæ elongate and very narrow, cylindrical, with three minute but distinct teeth just before apex; head strongly produced before the eyes; elytra mostly black .... *jousselini*, Guér., p. 484.

II. Club of antennæ excavate on its exterior side. (*Scaphipaussus*, subgen. nov.)

i. Club of antennæ with the margins of the excavation not setigerous, with or without distinct teeth.

1. Club of antennæ elongate, nearly four times as long as broad, with a very narrow excavation running along its entire length..................... *waterhousei*, Westw., [p. 485.

2. Club of antennæ not more than twice as long as broad, sometimes about as broad as long.

A. Anterior portion of pronotum not produced into a tooth at sides, at most shortly and bluntly extended, not, or scarcely broader than the posterior portion.

a. Club of antennæ oblong and parallel-sided; pubescence of elytra very thick and conspicuous (in fresh specimens).... *fichteli*, Don., p. 486.

- *b*. Club of antennæ more or less subtriangular, deep boat-shaped or cornucopia-shaped.
  - *a**. Disc of elytra dark.
    - *a*†. Size larger (6–6½ millim.); vertex without horseshoe-shaped impression .... *wroughtoni*, Wasm., p. 486.
    - *b*†. Size smaller (5–5½ millim.); vertex with a horseshoe-shaped impression, interrupted behind .... *soleatus*, Wasm., p. 487.
  - *b**. Elytra unicolorous testaceous: size very small (5 millim.); vertex with an impression surrounded by a dark raised line, interrupted in front...... *testaceus*, sp. n., p. 487.
- B. Anterior portion of pronotum produced into a more or less angular tooth at the sides.
  - *a*. Elytra with a single long, somewhat curved spine at each external apical angle .... *boysi*, Westw., p. 488.
  - *b*. Elytra with a conspicuous long tuft of hairs at each apical angle; colour light unicolorous testaceous .... *stevensianus*, Westw., p. 489.
  - *c*. Elytra without special setæ or tufts of hair at apex.
    - *a**. Colour entirely fulvous testaceous .... *fulvus*, Westw., p. 490.
    - *b**. Elytra with the disc more or less broadly black.
      - *a*†. Sides of elytra with long and stout wire-like setæ........ *jerdani*, Westw., p. 490.
      - *b*†. Sides of elytra without strong wire-like setæ.
        - *a*‡. Posterior portion of pronotum at least as broad as (sometimes broader than) the anterior part, widened in front. Size larger: 7–7½ millim. .... *thoracicus*, Don., p. 491.
        - *b*‡. Posterior portion of pronotum distinctly narrower than the anterior part, parallel - sided. Size smaller: 6 millim. ...... *suavis*, Wasm., p. 492.

ii. Club of antennæ with the lower margin of the excavation denticulate and setigerous, and the upper margin simple or obsoletely denticulate, but not setigerous.

- **1. Club of antennæ not more than three times as long as broad.**
  - **A. Raised basal margin of anterior**

portion of pronotum deeply excised in the middle and at sides, so that four teeth or processes are evident.. *quadricornis*, Wasm., [p. 492.

B. Raised basal margin of anterior portion of pronotum not quadridentate.

a. Elytra with regular and distinct rows of stiff yellowish-white bristles .... *seriesetosus*, Wasm., [p. 493.

b. Elytra without regular rows of bristles.

*a**. Posterior portion of the pronotum plainly broader than the anterior portion.

a†. Club of antennæ with the unexcavated margin straight. *denticulatus*, Westw., [p. 494.

b†. Club of antennæ with the unexcavated margin rounded.. *ploiophorus*, Bens., [p. 495.

*b**. Posterior portion of the pronotum narrower, or at least not broader than the anterior.

a†. Posterior tibiæ much thickened.

a‡. Club of antennæ less strongly impressed above.. *tibialis*, Westw., p. 495.

b‡. Club of antennæ more strongly impressed above. *pacificus*, Westw., [p. 496.

b†. Posterior tibiæ not thickened.

a‡. Posterior margin of the anterior portion of the pronotum not, or scarcely, emarginate before the lateral angles.

*. Form narrower; club of the antennæ with the excavation broad; pubescence coarser ...... *nauceras*, Bens., p. 497.

**. Form broader; club of the antennæ with the excavation narrow; pubescence finer .... *politus*, Westw., p. 497.

b‡. Posterior margin of the anterior portion of the pronotum plainly emarginate before the lateral angles .... *assmuthi*, Wasm., p. 498.

2. Club of antennæ long, at least three times as long as broad, subparallel-sided; colour of the upper surface sharply divided, anterior half black, posterior half testaceous............ *bicolor*, Raffr., p. 499.

iii. Club of the antennæ with the margins not denticulate, but with the lower margin finely setigerous .... *cardoni*, Wasm., p. 499.

238. **Paussus desneuxi**, sp. n.

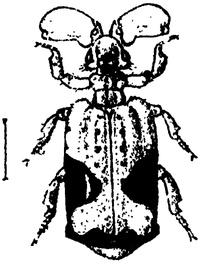

Fig. 215.
Paussus desneuxi.

Of a dull light brownish- and purplish-grey, variegated with darker and lighter colours, finely granulose; head very large, almost as long as the pronotum, strongly produced semicircularly before the eyes, fuscous, with a narrow light-coloured raised ridge running round the produced part and dividing off the eyes, which are small and scarcely prominent, temples swollen; clypeus slightly emarginate, with a fine channel proceeding from the emargination; vertex somewhat depressed, with two raised prominences between the eyes; antennæ light testaceous, almost ivory-coloured, with a few obscure brown markings at the apex and exterior margin, with the first joint large, subquadrangular, produced at its interior apex into a blunt tooth, second joint very large, broad, bean-shaped, longer than broad, with the interior margin rounded and acute, and the exterior margin broader, impressed, but not excavated, and produced into a blunt tooth at the base; the upper surface is somewhat uneven and the lower surface slightly convex, and there is a slight emargination at the apex; pronotum subcordiform, not transverse, about as broad as the head, brownish grey, with the sides darker, divided just in the middle by a rather fine furrow, and with a strong longitudinal channel from apex to base, sides rounded in front, contracted at the middle, and slightly widened to the base; the sides of the head, pronotum and shoulders, and of the elytra are furnished more or less with long, very fine setæ, which are not very evident and are probably thicker in fresh specimens; elytra oblong, with the shoulders rounded and prominent and divided off by a strong furrow, which causes the base of the elytra to appear raised into four divisions; of a brownish grey colour with a distinct shade of purple, dull, with a large spot just about middle, at the margins, and another at the apex, connected by a marginal band, shining polished pitchy black, as if enamelled; the space enclosed between these is light testaceous; on the basal half there are also two or three rows of more or less minute shining spots, and distinct traces of raised lines; pygidium triangular, produced into an obtuse angle, very finely sculptured; legs robust, compressed, variegated, tibiæ and tarsi brown, femora white, except base and apex, tarsi moderate, with the last joint shorter than the preceding joints taken together; underside for the most part whitish testaceous, shining, abdomen with the central part broadly fuscous longitudinally.

Length 8 millim.

Ceylon: Kandy (*Colonel Yerbury*).
Type in the British Museum.
Found in a nest of *Tetramorium* (*Xiphomyrmex*) *tortuosum* in May.

This extraordinary insect, which differs from any other species of the genus that I have seen, is the *Paussus* sp. 166 alluded to as undescribed by Wasmann (Krit. Verzeich. der Myrmek. und Termit. Arth. p. 121).

239. **Paussus spencei,** *Westw.*

Paussus spencei, Westwood, Proc. Ent. Soc. Lond. (3) i, p. 190 (1864); id., Thes. Ent. Oxon. 1874, p. 90, pl. 18, fig. 8.

Castaneous red, rather long, depressed, moderately shiny, elytra black, with the exception of the base and apex and the extreme margins; head large, produced before the eyes, punctured, with the clypeus emarginate and with a strong furrow on the vertex, between the base of which and the eyes are two impressions; antennæ with a kidney-shaped, rather broad club, finely punctured, not impressed, with the anterior margin acute and the posterior furnished in the middle of its edge with a long ovate impression, which is characteristic of the species; the external angle is bluntly produced; pronotum as broad as the head, with a transverse furrow, the anterior part simple, with the sides evenly rounded and with no lateral angles; posterior part of the same breadth as the anterior; the deep and wide excavation is furnished on each side with a large tuft of yellow hairs; elytra long, narrow, parallel-sided, with fine punctures set with yellowish setæ; legs reddish, all the femora and tibiæ robust, dilated, and more or less compressed.

Length 6 millim.

India (without special locality).

Type in the Oxford Museum.

The shape of the pronotum, the formation of the antennal club, and the robust femora and tibiæ will serve to separate the species. In size and general shape it is much like the African species, *P. spinicoxis*, Westw., but the latter has a shorter head, slender legs, and the club of the antennæ impressed much as in *P. hearseyanus*; the colour of the elytra, moreover, is uniform castaneous.

240. **Paussus affinis,** *Westw.*

Paussus affinis, Westwood, Trans. Ent. Soc. Lond. xvi, 1838, p. 646, pl. 33, figs. 36 & 37; id., Arcan. Ent. ii, 1845, p. 188, pl. 94, fig. 2.

Rufo-castaneous or ferruginous, shining, very finely punctured; head (with the eyes) about as broad as the apex of the pronotum; antennæ with the club shaped like an inverted jug without a handle, the external basal angle being produced into a conical and more or less sharp prominence; on its upper surface there are traces of oblique impressions, which are often obsolete; pronotum strongly impressed transversely in the middle, with the anterior portion rounded at the sides, which are constricted before the transverse impression and then slightly widened posteriorly before the base; elytra with the disc of each black, somewhat variably, but finely, sculptured, the punctures being very diffuse; pygidium finely punctured; legs moderate, more or less rufescent.

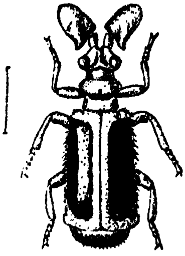
Fig. 216.
Paussus affinis.

Length 7–8 millim.

BURMA.

This species is closely allied to *P. hearseyanus*, from which it differs in its smaller head, comparatively longer pronotum, and in the almost total absence of oblique impressions on the club of the antennæ.

241. **Paussus cognatus**, *Westw.*

Paussus cognatus, Westwood, Trans. Linn. Soc. Lond. xix, 1841, p. 49; id., Arcan. Ent. ii, 1845, p. 189, pl. 94, fig. 3.

Rufo-castaneous, shining, with the disc of each elytron black; head about as broad as, or a little narrower than, the pronotum; clypeus not emarginate, front impressed on both sides of a raised central line; antennæ with the club much as in *P. affinis*; pronotum strongly and transversely impressed in the centre, slightly widened in front and behind, the anterior portion with a semicircular impression on each side of the middle line, with the sides rounded, and setose in fresh specimens; elytra extremely finely sculptured, almost smooth; legs ferruginous, tibiæ with two spurs; pygidium finely punctured, with two minute conical tubercles set at some distance from each other.

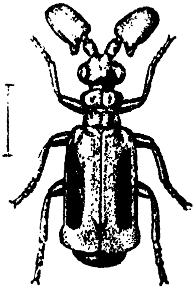
Fig. 217.
Paussus cognatus.

Length 8–9 millim.

BENGAL (*Melly*, *Westermann*); MADRAS: Madura.

Type in the Oxford Museum.

This species may be distinguished from *P. hearseyanus* by the absence of oblique impressions on the club of the antennæ and by the shape and sculpture of the pronotum, which is less dilated in front and has two large shallow impressions on each side of the median line, in the anterior portion. From *P. affinis* it differs by the same two impressions and by the shape of the thorax, which is not strongly widened in front and is almost parallel-sided. In Westwood's figure (*l. c.*) the club of the antennæ is represented as smaller than in these two species, but in some specimens it is rather larger.

242. Paussus schiodtei, *Westw.*

Paussus schiodtei, Westwood, Thes. Ent. Oxon. 1874, p. 85, pl. 16, fig. 6.

A rather narrow and elegant species, rufo-castaneous, with the elytra fuscous, except the base; head rather small, with very prominent eyes, which extend plainly on each side beyond the pronotum; vertex excavate; club of antennæ rather long, convex beneath, flat above, with four very strong transverse impressions (which make it almost appear jointed), apex rounded, base truncate, with the external angle sharply, but not strongly, produced: pronotum longer than broad, parallel-sided, with the anterior lateral angles not produced, impressed transversely and longitudinally, but not divided, although the apices of the side parts of the posterior portion are traceable in two tubercles; elytra very finely sculptured and setose; legs rufo-testaceous, tibiæ compressed, broader at the apex.

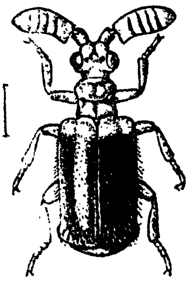
Fig. 218.
Paussus schiodtei.

Length 7 millim.

BENGAL.

This species may be known at once from *P. hearseyanus* and its allies by the four strong impressions on the club of the antennæ, by the excavate head and prominent eyes, and by the shape of the pronotum.

243. Paussus hearseyanus, *Westw.*

Paussus hearseyanus, Westwood, Proc. Linn. Soc. Lond. 1842, p. 133; id., Arcan. Ent. ii, 1845, p. 189, pl. 94, fig. 4; Wasmann, Notes Leyden Mus. xxi, 1899, p. 37, pl. 3, fig. 3.

Paussus hearseyanus var. *parvicornis,* Wasmann, op. cit. xxv, 1904, p. 76.

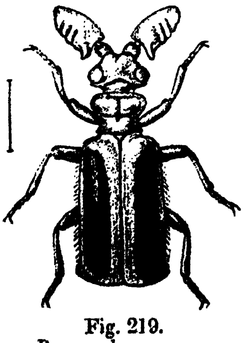
Fig. 219.
Paussus hearseyanus.

Of a more or less bright fulvo-castaneous colour, with the disc of each elytron black; head large, distinctly broader than long, with a transverse keel behind the eyes, which is slightly angled in the centre; clypeus slightly emarginate; antennæ with the club shaped much as in *P. affinis*, but with three distinct oblique impressions, which are very characteristic of the species;

pronotum at apex as wide as the head, with a strong central transverse impression, widened in front (where it is strongly rounded) and behind, and more or less plainly impressed longitudinally; elytra smooth and shining, with distinct but fine sculpture, and very finely alutaceous; pygidium distinctly punctured; legs more or less red, with darker shades, and with two spurs at the apex of the tibiæ.

Length 8 millim.

UNITED PROVINCES: Benares.; BOMBAY: Poona, Surat.

Var. **parvicornis**, *Wasm.*

This variety differs from the type-form in its considerably larger size, while the club of the antennæ is markedly smaller, and differs in shape, being more contracted in front and almost triangular; the head, moreover, is somewhat narrower than the pronotum, and the pronotum almost as long as broad, whereas in the type-form the head is at least as broad as the pronotum, and the latter is transverse.

Length 9–10 millim.

MADRAS: Bangalore.

Type in coll. R. Oberthür.

244. **Paussus horni**, *Wasm.*

Paussus horni, Wasmann, Zool. Jahrbuch. Syst. xvii, p. 154, pl. 5, fig. 6.

Rufo-testaceous, bright and shining, punctured, with fine and short pilose pubescence; elytra large, parallel-sided, with the disc of each furnished with an abbreviated longitudinal black line; head with the eyes projecting beyond the pronotum, thickly and finely punctured, forehead carinate, clypeus scarcely emarginate; antennæ with the club large, oval, very shiny, almost impunctate, with two deep longitudinal impressions on its upper side and one less pronounced, exterior angles produced into a large thick tooth; pronotum slightly transverse, longitudinally furrowed, but not divided, with the anterior portion much broader than the posterior, coarsely but obsoletely rugose-punctate, with the sides strongly rounded, posterior part alutaceous, much more finely and sparingly punctured; elytra much broader than, and more than three times as long as, the pronotum, alutaceous, with rows of rather large, but not deep, setigerous punctures; pygidium shining, with the margin bare, with coarse punctures, and between these finely punctured; legs stout, with the tibiæ narrow, but somewhat broader towards the apex, with stout tarsi and long sharp claws.

Length 7 millim.

CEYLON: Bandaravella (*Dr. W. Horn*).

Found under a stone in a nest of *Pheidole spathifera*, Forel, var. *yerburyi*, Forel.

This species belongs to the group of *P. hearseyanus*, *P. affinis*, and *P. sesquisulcatus*, but is much smaller, with the dark band on the elytra much narrower and shorter, and the front part of the pronotum much more coarsely punctured; the temples behind the eyes are longer and more strongly rounded than in either of those species; the shape of the hind margin of the head also affords distinctive characters.

245. **Paussus sesquisulcatus**, *Wasm.*

Paussus sesquisulcatus, Wasmann, Notes Leyden Mus. xxi, 1899, p. 37.
Paussus sesquisulcatus var. *brevicornis*, Wasmann, op. cit. xxv, 1904, p. 50.

Closely allied to *P. hearseyanus*, rufo-castaneous, with the elytra shining and the head and pronotum slightly shining, elytra black with the suture and margins red; head half as broad again as its length, with a raised keel behind the eyes (not always distinct), clypeus impressed and not emarginate; club of the antennæ short and broad, with the upper surface furnished with two oblique impressions, one being, as a rule, shorter than the other; pronotum distinctly longer than broad, with a deep central transverse furrow, the anterior part being much broader than the posterior, with the sides strongly rounded and the disc longitudinally furrowed, posterior portion impressed in the middle and furnished with an indistinct tubercle on each side; elytra strongly punctured, and with fine and scanty pubescence; femora more or less ferruginous.

Length 9–10 millim.

Bombay: North Guzarat (*Wroughton*); United Provinces: Dehra Dun (*Iyer*, Ind. Mus.); Bengal: Purneah District (*Paiva*, Ind. Mus.); Burma: Taung-ngu (*Corbett*).

The chief distinctions which are said to separate this species from *P. hearseyanus* appear to be the broader club of the antennæ and the fewer impressions on its surface, the narrower head, and the longer pronotum; the punctuation also of the elytra is stronger. It seems very doubtful, however, whether it is more than a variety of *P. hearseyanus*, as the furrows on the club of the antennæ and the shape of the pronotum are variable in different specimens.

Var. brevicornis, *Wasm.*

In this variety the club of the antennæ is much shorter than in the type-form, being hardly longer than its breadth at the base, and it is much more broadly rounded at the apex; the head is narrower and the size is larger.

Length 11–12 millim.

Bengal: Chota Nagpur, Barway (*Cardon*).

246. Paussus adamsoni, sp. n.

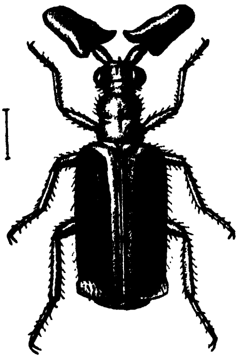

Fig. 220.
Paussus adamsoni.

Head and pronotum red, elytra dark, with the base, suture and apex red; head large, broader than the pronotum at the widest, eyes large and prominent; antennæ with the second joint of the club oblong and comparatively narrow, considerably longer than broad, with the internal basal angle produced into a strong and prominent tooth-like process; pronotum long and narrow, longer than broad, with the anterior angles quite rounded off, sides slightly narrowed in the middle and then very slightly and gradually widened to the base; the transverse furrow is slightly, and the longitudinal furrow very feebly, marked; elytra smooth and shining, with more or less regular rows of rather large, but feeble and very diffuse punctures, which are more distinct near the suture; legs comparatively slender, red.

Length 6½–7 miliim.

Burma: Minhu, Irawadi (*Col. C. H. Adamson*).

Type in the British Museum.

This species is easily distinguished by the oblong and comparatively narrow club of the antennæ and by the shape of the pronotum, which is only slightly constricted in the middle, and has the anterior angles completely rounded and not evident.

247. Paussus rufitarsis, *Westw.*

Paussus rufitarsis, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 638, pl. 33, figs. 25–27; id., Arcan. Ent. ii, 1845, p. 172, pl. 89, fig. 4; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 42–53, pl. 5, fig. 1.

Paussus baconis, Benson, Calcutta Journ. Nat. Hist. vi, 1846, p. 459; Westwood, Trans. Ent. Soc. Lond. v, 1847, p. 24.

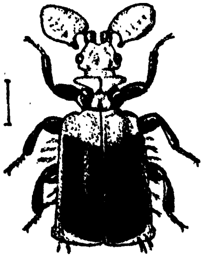

Fig. 221.
Paussus rufitarsis.

A small, rather broad, species with the front parts of a light flavescent or whitish yellow colour, and the hinder parts darker; head broad and not long, subtriangular, produced before the eyes, which are very small, with a rounded impression between the eyes and four minute round impressions, one on each side of the larger impression and one on each side just in front of these; these are not, however, very conspicuous, and the head looks simply impressed and uneven; antennæ with the first joint pitchy, and with a broad whitish yellow or testaceous subtriangular club, which is produced at the base externally into a pitchy spine; this club is not excavate, but on its widened hinder margin has a depressed oblong impression with four elevated transverse ridges running across it; pronotum about as broad as the head, divided; anterior portion short, testaceous, with the ridge feebly channelled, the lateral angles not very sharply produced; posterior portion dark at the sides, rather broad, with two rounded tubercles in the middle of the hind margin; elytra covering the pygidium, broad and short, almost subquadrate, slightly widened behind, pitchy, shining, with the base lighter and the margins and apex reddish, very obsoletely and finely punctured, outer margins with four or five equidistant tufts of short stiff reddish setæ, and the apex with two tufts on each side; legs pitchy, hinder pair broader than the others, with the femora a little dilated and the tibiæ compressed, tarsi red; underside entirely red.

Length 6 millim.

Bengal: Chota Nagpur, Barway and Nowatoli; **United Provinces**: Dehra Dun.

Found in company with *Pheidole latinoda.*

248. Paussus pilicornis, *Don.*

Paussus pilicornis, Donovan, Ins. Ind. 1800, pl. 5, fig. 4; Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 643, pl. 33, fig. 34; id., Arcan. Ent. ii, 1845, p. 173, pl. 89, fig. 1.

A very small and very distinct species, rufo-testaceous, with the elytra pitchy black except the extreme base, distinctly punctured and shining; head rather broad, subtriangular, with the clypeus emarginate, and with an impressed longitudinal line extending from the anterior margin to between the eyes, where there is a rather large circular impression; antennæ with a very strongly setose club, which is pear-shaped, the narrower part forming the apex, and the basal portion being almost circular, with the outer angle at the base produced into a short blunt point; the apical portion is bent upwards, with a slight keel along the anterior margin, and a transverse depression before the base on the upper side; pronotum about as long as broad, with the anterior portion broader than the posterior, uneven, with a rounded depression in the middle, and with the lateral angles produced,. but rounded; the centre is deeply sulcate, and the posterior part, which is almost parallel-sided, is made up of two large raised shiny spaces separated by a channel; elytra black, strongly punctured, setose; legs rufo-testaceous, rather long and slender.

Length 4 millim.

Bengal.

This insect may at once be known by its small size, the shape of the pronotum, and especially by the peculiar shape of the setose club of the antennæ.

249. Paussus fletcheri, sp. n.

Rather robust, shining, front parts and the antennæ red, elytra black, with the base rather broadly and the suture very narrowly red, very scantily pubescent; head rather large, eyes not prominent, vertex with a small circular depression; antennæ with the first joint large and broad and the second bean-shaped, depressed and obscurely channelled on its outer edge, longer than broad, rounded at the apex and produced at the internal angle into a tooth-shaped prominence; pronotum strongly divided by a deep transverse impression, the front part very broad, produced at the sides into large prominent angles, and emarginate in the centre; hinder part much narrower, parallel-sided, very strongly impressed in the middle longitudinally; elytra parallel-sided, very feebly and confusedly punctured; legs rather robust, red, with the femora darker, intermediate and posterior tibiæ produced rather sharply at their external angles; underside reddish.

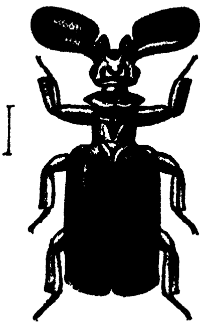

Fig. 222.
Paussus fletcheri.

Length 6½ millim.

CEYLON: Diyatalawa (*T. Bainbrigge Fletcher*).

Type in the British Museum.

This species is very distinct; superficially it most nearly resembles *P. quadricornis*, but is in an entirely different section, the antennæ having the second joint of the club bean-shaped and closed, and not boat-shaped and open.

250. Paussus saundersi, *Westw.*

Paussus saundersi, Westwood, Trans. Linn. Soc. Lond. xix, 1841 p. 50; id., Arcan. Ent. ii, p. 190, pl. 94 fig. 6.

Entirely of a fulvous or fulvo-castaneous colour, with the head and pronotum somewhat darker; head about as broad as pronotum, with two semicircular impressions between the eyes; antennæ with a long oblong-ovate club, with the base externally produced into a hook-like setigerous process; pronotum longer than broad with a deep central furrow ending in a small lateral tubercle on each side, anterior portion somewhat raised, with the sides strongly rounded; legs slender, tibiæ with two apical spurs.

Length 7–8 millim.

INDIA.

The club of the antennæ is about as long as in *P. hardwicki*, but in shape is much more rounded, and the insect in this respect is intermediate between the last-named species and the *P. hearseyanus* group.

251. **Paussus hardwicki**, *Westw.*

Paussus hardwicki, Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 649, pl. 33, figs. 39–40; id., Arcan. Ent. ii, 1845, p. 189, pl. 94, fig. 5.

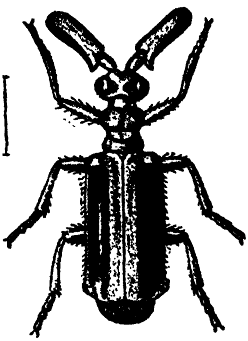

Fig. 223.
Paussus hardwicki.

Rufo-castaneous, shining, punctured, elytra with the disc more or less dark; head broader than long, raised in the middle, with the eyes very prominent; antennæ with a long cylindrical club, parallel-sided, about three or four times as long as broad, with the base externally produced into a hook-like process; pronotum much longer than broad, divided by a deep transverse central furrow, the anterior portion with the sides dilated and strongly rounded, about as broad at its widest part as the head (including the eyes), with strong punctures; posterior portion slightly dilated to the base, but not furrowed; elytra strongly punctured, finely setose at the sides; legs slender, dark, tibiæ with two spurs.

Length 8–9 millim.

NEPAL; UNITED PROVINCES: Almora.

This species may at once be known by the club of the antennæ, which is formed on much the same pattern as in *P. hearseyanus* and its allies, but is much longer and narrower.

252. **Paussus jousselini**, *Guér.*

Paussus jousselini, Guérin, Rev. Zool. 1838, p. 21; Westwood, Trans. Ent. Soc. Lond. ii, p. 90; id., Arcan. Ent. ii, 1845, p. 169; Olivier, Ann. Soc. Ent. France (6) iii, 1883, p. 196, pl. 7, fig. 1; Raffray, Nouv. Arch. Mus. Paris (2) ix, 1887, pp. 32–46.

Paussus sinicus, Westwood, Proc. Linn. Soc. Lond. ii, 1849, p. 57; id., Thes. Ent. Oxon. 1874, p. 85, pl. 8, fig. 10.

Of a dull dark reddish colour, with the elytra black, except the base, and sometimes the apex, or entirely dark, with the apex of the elytra and the abdomen reddish; head much produced before the eyes, uneven, granulate, with the clypeus emarginate, and the vertex channelled and set with a rather strong tubercle in the middle, behind which are two small tubercles which sometimes coalesce; antennæ granulate, dull, with the first joint large and subquadrate, and the second elongate, subcylindrical, five or six times as long as broad, widened at base and apex, with the outer basal angle slightly produced, and the apex dilated and clavate and furnished with three small, but distinct, sharp teeth set in a shallow excavation; pronotum divided, long, subparallel-sided, with the anterior part somewhat longer than usual, deeply emarginate in the centre, with the lateral angles rather sharply produced; posterior part with the sides nearly parallel, deeply and broadly impressed in the middle, and with a tuft of yellow hair on each side of the dividing sulcus; elytra considerably broader than the base of the pronotum, almost smooth, with a small but distinct tubercle at the outer apex of each; legs not elongate, rather stout, and granulose.

Length 8 mm.

BURMA: Pegu, Bhamo (*Fea*); CHINA: Hong-Kong.

A specimen before me, from Mr. Andrewes' collection, was taken by Fea in company with a very small reddish-brown ant.

Raffray (*l. c.* p. 32) expresses his strong belief that *P. sinicus* is synonymous with this species, and in his catalogue (p. 46) places them together. Desneux (Genera Insectorum, Paussidæ, 1905) again separates them, but, as he is merely recording a list of species, gives no reason for so doing. Westwood's figure of *P. sinicus* agrees almost entirely with the description of *P. jousselini* above given, except that it has two small tubercles on the disc of each elytron.

253. **Paussus waterhousei**, *Westw.*

Paussus waterhousei, Westwood, Thes. Ent. Oxon. 1874, p. 90, pl. 16, fig. 4; Wasmann, Notes Leyden Mus. xxi, 1899, p. 40, & xxv, 1904, p. 68.

Rufo-piceous, not shining, very finely and somewhat granulosely sculptured; head in front deeply emarginate and channelled; vertex with a round polished excavation, with the sides raised; antennæ with a very elongate club, rounded at the apex, and bluntly and slightly produced externally at the base, with the sides almost parallel, and with a very narrow excavation stretching along its whole length, each margin with five equidistant tubercles; neck short, but distinct; pronotum divided, the anterior part broader than the head and sharply angled at each side, broader than the posterior part which has the sides almost parallel; centre of the disc deeply impressed, with the sides thickly setose; elytra rather broad, parallel-sided, with the shoulders strongly raised, and with a small but very distinct elongate-oval impression on the anterior third, near the suture; the sides are set with long pitchy setæ; legs comparatively long and slender, with the tibiæ compressed; there is a tuft of yellow hairs on each side of the pygidium.

Length 5–8 millim.

BURMA: Momeit; MALAY STATES; SUMATRA: Tandjong Morawa, Serdang.

The species was originally described by Westwood from Penang; the other specimens from Burma, Malacca, and Sumatra are smaller, with the side angles of the anterior part of the pronotum (according to Wasmann) not so much produced, and its breadth scarcely more than that of the head; the circular impression on the vertex is, moreover, divided into two. These insects, however, can hardly, as Wasmann observes, be regarded as belonging to a different species.

254. Paussus fichteli, *Don.*

Paussus fichteli, Donovan, Ins. Ind. 1800, pl. 4, fig. 3; Westwood, Trans. Linn. Soc. xvi, 1838, p. 641, pl. 33, figs. 31–33; id., Arcan. Ent. ii, 1845, p. 181, pl. 90, figs. 5, 8, 9; Saunders, Trans. Ent. Soc. Lond. ii, p. 83, pl. 9, fig. 1; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 47, 55, pl. 5, fig. 5.

Rufo-testaceous or rufo-castaneous, with the elytra black, except the base, apex and extreme margins, the whole surface clothed more or less distinctly with whitish pubescence (which is easily denuded); head comparatively long, hexagonal, with the eyes not very prominent, with a depression on the vertex, the sides of which are raised into two shiny tubercles; antennæ with the club rectangular, if viewed from the side, a little produced on its inner side at the apex which is angled, and produced into a long spine externally at the base, broadly excavate, the excavation being set with strong teeth on the margins which are not setigerous; the upper surface is more or less distinctly impressed with transverse furrows; pronotum rather narrow, parallel-sided, longer than broad, deeply divided into two almost equal parts, the anterior angles rounded and not produced; elytra very finely sculptured; legs rather long and slender, red; the pubescence is thicker (in fresh specimens) on the pronotum, head, and antennæ, and longest on the outer and hinder margins of the elytra; in any case it is much finer than the setæ in several of the allied species.

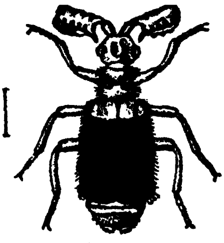

Fig. 224.
Paussus fichteli.

Length 6 millim.

Bengal: Chota Nagpur, Nowatoli, Barway, Mansar.

This species has been found with *Pheidole latinoda*, and appears to be not uncommon, as Wasmann records 134 examples from Chota Nagpur. The shape of the antennal club, the simple apex of the pronotum, and the pubescence will easily distinguish this species from its allies.

255. Paussus wroughtoni, *Wasm.*

Paussus wroughtoni, Wasmann, Kritisch. Verzeich. Myrmek. Termit. Arth. 1894, p. 215; id., Notes Leyden Mus. xxv, 1904, p. 43 pl. 5, fig. 3.

Of a tawny luteous colour, smooth and somewhat shining, with the disc of the elytra pitchy, and the posterior part of the pronotum pitchy or blackish pitchy at the sides; head broad, with the eyes prominent, clypeus strongly deflexed in the middle, forehead not channelled, vertex with a broad round excavation; antennæ with a broad obtusely triangular club, with the apex almost truncate, excavated, the posterior part of the excavation being transversely sulcate; pronotum divided into two parts, as broad as the head, with the sides of the anterior part rounded, and the angles bluntly rounded, the posterior part scarcely narrower than the anterior, with the anterior angles raised, the disc impressed in the middle and longitudinally channelled; elytra very finely coriaceous, with a single thin seta on each side near the apical angle; legs moderate, with the tibiæ not dilated.

Length 6–6½ millim.

BOMBAY: Poona.

Several examples were taken by Wroughton in nests of *Pheidole wroughtoni*, Forel, in company with *Paussus soleatus*. According to its describer (*l. c.* p. 216), the species is closely allied to *P. fulvus*, *P. boysi*, and *P. stevensianus*. From the first of these it differs in its dull upperside, finely alutaceous elytra, the absence of a longitudinal furrow on the forehead, the rounded side-angles of the front part of the pronotum, and the narrow legs; from *P. boysi* it further differs in not having a strong flexible spine at the apex of the elytra, and from *P. stevensianus* by the formation of the vertex.

256. **Paussus soleatus**, *Wasm.*

Paussus soleatus, Wasmann, Kritisch. Verzeich. Myrmek. Termit. Arth. 1894, p. 216.

Very closely allied to the preceding, of which it might, perhaps, be considered a variety; it is, however, a shorter and smaller insect, with the head broader, and with the elytra all black except the base and apex. According to Wasmann, the chief difference lies in the fact that on the head there is a horseshoe-shaped impression, the anterior part of which is formed by the margin of the fovea on the vertex and the middle part by the margin of the frontal furrow; it appears to be interrupted behind, and not in front as in *P. testaceus*.

Length 5½ millim.

BOMBAY: Poona.

Several examples were taken by Wroughton in nests of *Pheidole wroughtoni*, Forel, in company with the preceding species.

257. **Paussus testaceus**, sp. n.

A small testaceous or light castaneous species; head large, hexagonal, not much shorter than the pronotum, dull and rather strongly granulose, vertex with a deep impression surrounded by a dark raised line, which is interrupted in front; eyes small, rather prominent; antennæ with the first joint robust, subquadrangular, club rather short, subtriangular, compressed, excavate, with the apex rounded and the base truncate and produced externally in a short tooth, excavation with the sides very feebly scalloped, not dentate or setigerous, inner side impressed, upper surface of club with five dark transverse impressions at the edge of the excavation; pronotum narrow, longer than broad, divided by a furrow, anterior part dull, granulose, strongly emarginate in the middle, with the sides scarcely produced; posterior part shining, broadly impressed in the middle, with the lateral lobes narrowly black at the apex; elytra shining, very slightly sculptured, setose at the apex; legs long, not dilated.

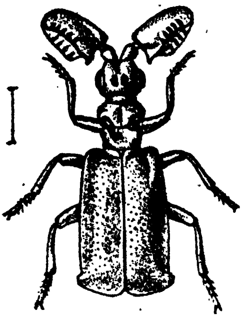
Fig. 225.
Paussus testaceus.

Length 5 millim.

TENASSERIM: Tavoy (*Doherty*).

Type in the British Museum.

This species appears to be allied to *P. wroughtoni*, Wasm., and *P. soleatus*, Wasm., but is smaller and differently coloured and is remarkable for the dull granulose front parts and the very smooth and shining elytra. From *P. fichteli*, which it somewhat resembles in the shape of the pronotum, it differs entirely by the shape of the club and the almost total absence of pubescence.

258. **Paussus boysi**, *Westw.*

Paussus boysi, Westwood, Arcan. Ent. ii, 1845, p. 177, pl. 92, fig. 2; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 43, 54, pl. 5, fig. 2.

Yellowish testaceous, with the elytra slightly more rufescent, and with the basal joint of the antennæ, the sides of the posterior part of the pronotum, and the disc of the hinder portion of the elytra more or less obscurely dark (but variable); head subtriangular, much produced in front of the eyes, angulate in front, vertex deeply channelled, the channel ending in a large round fovea between the eyes; neck short, punctured; antennæ with the first joint rugose, and the second large, broad, boat-shaped, compressed, granulose, with the keel uneven and the deep excavation having its sides scalloped and subcrenulate (as in *P. stevensianus* and *P. fulvus*), and not denticulate or setigerous; outer basal angle strongly produced, pitchy; pronotum divided, anterior part convex

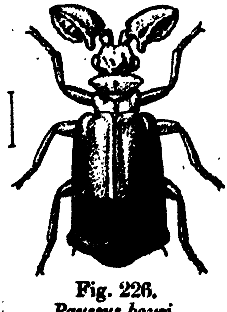
Fig. 226.
Paussus boysi.

and smooth, about as wide as the head, obscurely channelled, but not emarginate in the middle, with the lateral angles produced rather sharply on each side; posterior part channelled in the centre and raised on each side of the channel; elytra rather variable in colour, dull, very finely sculptured, subalutaceous, with the follicles at the external apex very distinct, and close to these a long curved moveable spine (not a tuft as in *P. stevensianus*), which is characteristic of the species; underside castaneous; legs moderate, not dilated.

Length 7 millim.

BENGAL: Nowatoli, Barway (*Cardon*).

First taken by Captain Boys by sweeping in high grass under a Munja clump (*Saccharinum munja*). It has occurred in very large numbers (135 examples) in Chota Nagpur, where it was found by Cardon in company with *Pheidole latinoda*. Wasmann (*l. c.* p. 54) says that the colour of these examples is brighter than as described and figured by Westwood, and it is apparently very variable, the dark colour of the elytra being sometimes much reduced, and occasionally quite wanting.

The species is allied to *P. stevensianus* and *P. fulvus*. From the former it may be known by the circular excavation on the vertex and the fact that it possesses a long thorn-like seta and not a fascicle or brush at the external apex of the elytra; the latter species has neither thorn-like seta nor fascicle, and is smaller, duller and more uniformly coloured, with the legs broader. It is also akin to *P. wroughtoni* and *P. soleatus*, with which Wasmann compares it; from both of these it may be known by its brighter and more luteous or straw colour, and by the presence of the apical thorn. I have not seen a specimen of *P. wroughtoni*, but to judge by Wasmann's photograph it is extremely closely allied to *P. boysi*.

259. Paussus stevensianus, *Westw.*

Paussus stevensianus, Westwood, Trans. Linn. Soc. Lond. xix, 1841 p. 48; id., Arcan. Ent. ii, p. 176, pl. 90, fig. 2.

Of a pale luteous colour; head large, produced before the eyes, with the clypeus distinctly emarginate, and with two large tubercles between the eyes; antennæ with a large broad punctured club, having its anterior (or internal) margin curved, and the posterior (or external) not broadly excavate, the margins and the excavation being sinuate and raised in tubercles, but not dentate, basal external angle bluntly produced; pronotum divided, anterior part short, raised, with the lateral angles rather sharply produced, the centre of the ridge emarginate, posterior part scarcely narrowed to the base, about as broad as the anterior; elytra broad, somewhat shining, a little darker behind, very finely sculptured, with a distinct fascicle of rigid reddish setæ at each apical angle; legs elongate and slender, with the posterior tibiæ slightly dilated; anal segment of the abdomen with two curved horny points; underside of the mesosternum and abdomen darker.

Length 7½–8 millim.

INDIA (no definite locality).

From Westwood's description this seems to be a very distinct species.

260. Paussus fulvus, *Westw.*

Paussus fulvus, Westwood, Trans. Linn. Soc. Lond. xix, 1841, p. 47; id., Arcan. Ent. ii, 1845, p. 175, pl. 90, fig. 3.

Of a uniform fulvo-luteous or bright luteous brownish colour; head produced before the eyes, deeply and broadly channelled in front, with the channel meeting a very large circular fovea between the eyes; antennæ with a large broad club, boat-shaped (much as in *P. boysi*), strongly impressed at the sides, with the keel uneven, and the wide excavation obscurely scalloped or subcrenulate and not setigerous, outer side with traces of ridges, outer basal angle somewhat strongly produced; pronotum divided, a little broader than the head, anterior portion rather sharply produced at the sides, feebly channelled, but not emarginate in the middle; posterior portion channelled and somewhat raised on each side of the channel; elytra dull, finely rugose, with very faint traces of raised lines, with the apical follicles well marked, but without a brush of hairs or a thorn-like seta; legs rather broad, tibiæ compressed, the posterior pair somewhat curved and rather broader than the others.

Length 6 millim.

INDIA.

261. Paussus jerdani, *Westw.*

Paussus jerdani, Westwood, Trans. Ent. Soc. Lond. v, 1847, p. 26, pl. 2, fig. 1; id., Cab. Orient. Ent. pl. 41, fig. 5; id., Thes. Ent. Oxon. 1874, p. 88, pl. 18, fig. 4.

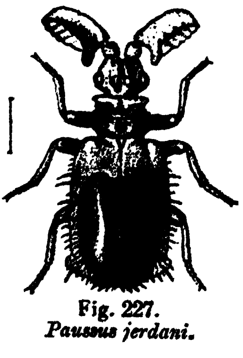

Fig. 227. *Paussus jerdani.*

Of a dull rufous or rufo-castaneous colour, with the posterior part of the pronotum, the disc of the elytra (more or less), the femora, and the sternum dark; head produced in front of the eyes, with the anterior angles marked, deeply channelled and strongly raised behind into a large tubercle, which is hollowed out and contains two more or less distinct small tubercles; antennæ with both joints closely granulate, the first stout, the second large, boat-shaped, deeply and broadly excavated, with the keel uneven and the edges of the emargination scalloped and impressed within but not setigerous, external basal angle produced into a blunt point; the base is emarginate and not incised; pronotum very deeply divided, the anterior part rather variable in breadth, with the hind margin emarginate in the middle and the lateral angles acutely produced, but more so in some examples than others; posterior part broader than the anterior, with the sides strongly rounded, deeply incised and bidentate on its front margin, with a tuft of yellow hairs on each side near the anterior lateral angles; elytra much broader than the base of the pronotum, slightly widened behind, very finely sculptured, with the base more broadly red than the apex, and with the sides and apex set with very long wiry setæ; pygidium also setose; legs rather short and stout, with the tibiæ slightly dilated; sterna punctured.

Length 6–7 millim.

BENGAL: Siripur Sarda (Ind. Mus.); MADRAS: Nilgiri Hills (*H. L. Andrewes*).

This species is very distinct by reason of the long and numerous wiry setæ which clothe the sides of the elytra, and in fresh specimens exceed half the breadth of the elytra. It is most nearly allied to *P. thoracicus*, from which it may be known by the much shorter lateral setæ, and the shape of the posterior part of the pronotum.

262. **Paussus thoracicus**, *Don.*

Paussus thoracicus, Donovan, Ins. Ind. 1800, pl. 5, fig. 2; Westwood, Trans. Linn. Soc. Lond. xvi, 1838, p. 640, pl. 33, figs. 28–30; id., Arcan. Ent. ii, 1845, p. 180, pl. 90, fig. 4; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 44 & 54.

Paussus trigonicornis, Latreille, Gen. Crust. Ins. iii (3), pl. 11, fig. 8.

Red or rufo-castaneous, with the sides of the posterior part of the pronotum and the elytra, except the base and apex, black; head large, much produced in front of the eyes, with the anterior angles well marked, narrower than the pronotum, with an impressed line extending from the clypeus to the vertex, which bears two small elevated curved ridges shaped like a horse-shoe, the space between with two small tubercles; antennæ with a large deep boat-shaped subtriangular club, deeply excavated, with the margins scalloped and not strongly denticulate, the base is bluntly produced externally; pronotum very deeply excavate in the middle, anterior part produced into sharp angles at the sides, raised and emarginate in the centre; posterior part with the sides in front considerably raised, large and broad; elytra with yellowish setose scales on the disc, and with long but

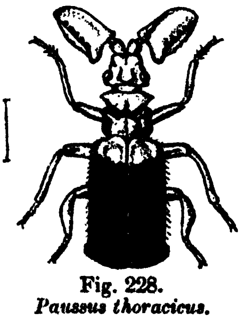

Fig. 228.
Paussus thoracicus.

not strong setæ at the sides; legs long and rather slender, tibiæ without spurs; abdomen with two incurved fascicles of hairs at the apex.

Length 7–7½ millim.

BENGAL.

The host of this species, according to Wasmann, is probably *Pheidole latinoda*. It may be known by the shape of the head and pronotum, and the broad and large mussel-shaped club of the antennæ.

263. **Paussus suavis**, *Wasm.*

Paussus suavis, Wasmann, Kritisch. Verzeich. Myrmek. Termit. Arth. 1894, p. 215; id., Notes Leyden Mus. xxv, 1904, pp. 44 & 54, pl. 5, fig. 4.

Ferruginous, entirely dull, with the disc of the elytra broadly black; head large, with the eyes comparatively small, clypeus emarginate, forehead longitudinally sulcate, vertex foveolate, with the margin of the fovea raised on both sides, apparently auriculate; antennæ with a triangular club, which is broad and strongly compressed, and deeply and broadly excavate, the lower side of the excavation being transversely sulcate; pronotum deeply divided, with the anterior part very short, almost four times as broad as its length, with the lateral angles rather strongly but somewhat bluntly produced, and emarginate behind the processes; posterior part distinctly narrower and longer, and broadly sulcate longitudinally; elytra broad and ample, coriaceous, with very short flavous pubescence, and with long but not strong fulvous setæ at the sides and apex; legs rather slender, tibiæ not dilated.

Length 6 millim.

BOMBAY: Belgaum (*H. E. Andrewes*), Kolaba (*R. Wroughton*).

One female example was taken by Wroughton in a nest of *Pheidole latinoda*.

This species is closely allied to *P. thoracicus*, from which it differs in the longer and more sharply triangular club of the antennæ and the different shape of the posterior part of the pronotum, which in the last-named insect is at least as broad as the anterior part, and is widened in front, while in *P. suavis* it is distinctly narrower than the anterior part and is parallel-sided; *P. thoracicus*, moreover, is a larger insect.

264. **Paussus quadricornis**, *Wasm.*

Paussus quadricornis, Wasmann, Notes Leyden Mus. xxi, 1899, p. 43, pl. 4, fig. 8 (club of antenna), & xxv, 1904, p. 48.

Black, with the head, the club of the antennæ, the anterior part of the pronotum, and the base, margins and extreme apex of the elytra red, slightly shining; head punctured, with the clypeus emarginate, and the vertex raised into a protuberance and furnished with a rather large simple cavity; antennæ with the first joint strongly punctate, and the club, viewed from the side, elongate-quadrate and parallel-sided, as broad at base as at apex, sharply keeled on one side and on the other deeply and broadly excavate, the excavation with the margins obtusely dentate, and with the setæ of the lower margin short, basal exterior angle strongly produced and broadly reflexed; the whole club, except the upper margin, is dull and very thickly punctured; pronotum shining, punctured, a little broader than long and a little narrower than the head, with the base and apex of about equal breadth; the anterior part short, strongly raised, with the sides deeply excised and bidentate, so that four teeth or prominences are evident on the raised basal margin; the posterior part deeply and broadly impressed in front, with the depression smooth, longitudinally channelled: elytra parallel-sided, rather dull, thickly alutaceous, with their lateral margins furnished with long red setose hairs; pygidium with yellowish setæ; legs moderate, with the tibiæ slightly compressed, but not dilated.

Length 6 millim.

BURMA: Momeit (*Doherty*).

This species belongs to the *P. denticulatus* group; it appears to be easily distinguished from the species hitherto described by the quadridentate basal margin of the anterior portion of the pronotum.

Var. **castanea**, nov.

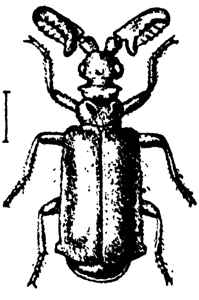

Fig. 229.
Paussus quadricornis var. *castanea*.

Larger than the type, entirely of a dark castaneous colour, with the elytra rather shiny; the sides of the anterior portion of the pronotum are not deeply excised but are furnished with four distinct teeth or prominences.

Length 7½ millim.

TENASSERIM: Mergui (*Doherty*).

Type in the British Museum.

It is possible that this may be a new species. The surface is nearly bare of pubescence, but it is probably rubbed, as the long reddish setæ are apparent on the extreme margins. Described from a single specimen.

265. **Paussus seriesetosus**, *Wasm.*

Paussus seriesetosus, Wasmann, Notes Leyden Mus. xxv, 1904, pp. 59 & 72, pl. 6, fig. 3.

A small species, ferruginous, with the posterior angles of the pronotum and the disc of the elytra black (sometimes the latter are entirely black with the exception of the base and apex); head and pronotum dull, coriaceous, the former with the clypeus slightly impressed and scarcely emarginate, and the vertex raised, with a minute fovea on the apex of the elevation; antennæ with the club boat-shaped, much as in *P. denticulatus*, but differently shaped, being less parallel-sided and more narrowed towards the apex, with the margins of the excavation less strongly toothed, but with the teeth of the inferior margin furnished with much longer and coarser setæ; pronotum with short fulvous pubescence, strongly divided; anterior part dull, elevated, with the lateral angles rounded and not produced, about as broad as the head; posterior part twice as broad as long, broader than the anterior part, very strongly foveate in front, with the posterior angles rounded; in fresh specimens the transverse central furrow has a rather strong tuft of yellow hairs on each side; elytra long and flat, smooth and somewhat shining, very finely alutaceous, with three or four very distinct longitudinal rows of stiff short yellowish white setæ on each, which look like raised carinæ in fresh specimens; at the sides and apex there are longer yellowish setæ, and the pygidium has a row of long yellowish setæ, and inside this a row of reddish hairs and small tufts.

Length 5 millim.

MADRAS: Nilgiri Hills (*H. L. Andrewes*), Travancore, base of Western Ghats (*Annandale*); BENGAL: Calcutta (Brit. Mus.), Biru, Chota Nagpur, with *Pheidole javana* (*Cardon*).

This little species, when fresh, is one of the most distinct of the whole genus by reason of the very regular longitudinal rows of short setæ on the elytra which look like yellowish white or whitish yellow carinæ; these are apparently very easily rubbed off, and the elytra are then quite bare and smooth; the shape of the pronotum, and, to a less extent, of the antennal club will, however, serve to distinguish the species.

266. **Paussus denticulatus**, *Westw.*

Paussus denticulatus, Westwood, Arcan. Ent. ii, 1845, p. 179, pl. 92, fig. 1; id., Thes. Ent. Oxon. 1874, p. 88, pl. 16, fig. 12; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 47 & 55, pl. 6, fig. 1.

Of a dark brownish chestnut colour, with the disc of the elytra and the hinder part of the pronotum darker; head narrower than the pronotum, club of antennæ large, boat-shaped, rather regular, with the excavation wide and strongly denticulate and the base incised in the centre; pronotum divided, with the anterior part obtusely toothed in front at the sides, and distinctly narrower than the posterior part, which is very broad compared with the allied species; elytra parallel-sided, finely sculptured, strongly setose; legs somewhat long and slender.

Length 6–7 millim.

BOMBAY: Ahmadnagar; CENTRAL INDIA: Mhow (*Boys*).

This species may be at once known by the very broad posterior portion of the pronotum, which is nearly three times as broad as long and is distinctly broader than the anterior part. The upper and under sides of the excavation of the antennal club are set with very sharp teeth, the under ones being furnished with a single very long seta; the elytra are furnished with long reddish yellow setæ on their whole disc and at the sides, and there is no difference in length between the discal and lateral setæ. Wasmann (*l. c.* p. 56) adds other characters, but these are quite sufficient to distinguish the species.

267. **Paussus ploiophorus**, *Bens.*

Paussus ploiophorus, Benson, Calcutta Journ. Nat. Hist. vi, 1846, p. 463; Westwood, Trans. Ent. Soc. Lond. v, p. 25; id., Thes. Ent. Oxon. 1874, p. 87, pl. 16, fig. 11.
Paussus phlœophorus (in error), Gem. & Har. Cat. ii, p. 705.

Blackish chestnut; head a little longer than in *P. nauceras*, antennæ with the club rather broader and more rounded, with a deep excavation which has the margins denticulate (the lower denticulations being setigerous), and with the base incised in the centre; pronotum much as in *P. denticulatus*, but a little narrower; elytra with the disc dark, polished, finely setose; apex of abdomen with two distinct fascicles of short hairs.

Length 5–5½ millim.

United Provinces: Rohilkhand.

This insect is closely allied to *P. nauceras* and *P. denticulatus*, being intermediate between them. From the former it differs in the shape of the antennal club, and from the latter in this character and also in the narrower posterior portion of the pronotum, as compared with the anterior portion.

268. **Paussus tibialis**, *Westw.*

Paussus tibialis, Westwood, Trans. Linn. Soc. Lond. xix, 1841, p. 47; id., Arcan. Ent. ii, 1845, p. 174, pl. 90, fig. 1.

Castaneous or rufo-castaneous, shining, with the disc of the elytra black; head rather narrower than the pronotum, convex, with the clypeus scarcely emarginate, strongly channelled on the vertex, the sides behind the eyes oblique and punctured; club large, somewhat ovate, boat-shaped, uneven and impressed, with the keel sharp and the outer apical angle produced and rounded, the excavation deep, with the upper margin simple, and the lower denticulate and setigerous, marked internally behind the denticles with several small impressions; pronotum deeply divided, the anterior part much broader than long, with the lateral angles bluntly produced and not dentate, the posterior part widely excavate in front, almost as broad as the front portion; elytra shiny, extremely finely sculptured; anterior and intermediate femora slender and cylindrical, posterior femora and tibiæ shorter and much more robust, dilated and compressed; tibial spurs wanting.

Length 6 millim.

BENGAL.

This insect may be easily distinguished from all its allies, except *P. pacificus*, by the formation of the posterior tibiæ; the species appears to be very rare, and Wasmann makes no allusion to it in his notes on the allied species. Westwood obtained the specimen on which he described it from Westermann at Copenhagen. In the face of Westwood's separate descriptions, it is hardly possible to regard this and the succeeding species as synonymous without comparing the type-specimens, which I am unable to do. I am strongly of opinion, however, that they are identical.

269. **Paussus pacificus**, *Westw.*

Paussus pacificus, Westwood, Trans. Ent. Soc. Lond. 1855, p. 81; id., Thes. Ent. Oxon. 1874, p. 88, pl. 16, fig. 7.

A small and broad species, of a castaneous colour, with very scattered fine yellowish pubescence; the sides of the posterior part of the pronotum and the greater part of the disc of the elytra are black and shining; head emarginate and channelled in front, with a depressed semicircular tubercle in the centre at the base of the eyes; club of the antennæ irregularly boat-shaped, subovate, broader at base than at apex, with the disc on each side longitudinally impressed from near the apex to the base, basal margin produced externally, excavation with its upper margin straight and simple, the lower margin with six or seven small teeth and the same number of transverse striæ on the edge of the inner surface; pronotum divided by a broad and not very deep furrow, the anterior part a little broader than the head, raised, with the lateral angles bluntly rounded and not sharply produced, posterior part as broad as the anterior, gradually narrowed to the base; elytra much broader than the pronotum, very finely sculptured, with the sides set with short, red, curved setæ; pygidium castaneous, with the raised margin black; legs dark castaneous, the anterior and the posterior pairs slender, the posterior pair short, with the tibiæ much dilated and compressed.

Length 5½–6 millim.

CEYLON (coll. *Dohrn*).

The laterally impressed antennal club, the bluntly rounded angles of the anterior portion of the pronotum, and the short posterior legs with the thickened tibiæ will serve to distinguish the species.

270. Paussus nauceras, *Bens.*

Paussus nauceras, Benson, Calcutta Journ. Nat. Hist. vi, 1846, p. 641, Westwood, Trans. Ent. Soc. Lond. v, 1847, p. 25; id., Thes. Ent. Oxon. 1874, p. 87, pl. 16, fig. 8; Wasmann, Notes Leyden Mus. xxv, 1904, pp. 47 & 56, pl. 6, fig. 2.

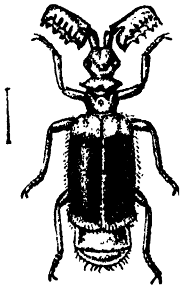

Fig. 230. *Paussus nauceras.*

Rather narrow, of a fusco-castaneous colour, not shining; head narrower than the pronotum, impressed in front, eyes not very prominent, clypeus emarginate; club of antennæ boat-shaped, with the margins denticulate, the inferior denticulations being setigerous, and with the base rather deeply incised; pronotum divided into two parts by the very strong sulcation of the central portion, the anterior part raised and ridged and produced on each side into a strong sharp prominence, the posterior part rather long, with the sides almost straight; elytra dark, except at the base, sides, and apex, very finely sculptured, and set with long yellowish setæ, which are stronger at the sides; legs ferruginous, rather slender.

Length 5–6 millim.

BENGAL: Biru, Chota Nagpur; UNITED PROVINCES: Mussoori, Landaur.

A large series has been taken by Cardon at Biru and Nowatoli; in the former locality it has occurred with the ant, *Pheidole javanica*, as recorded by Wasmann.

271. Paussus politus, *Westw.*

Paussus politus, Westwood, Proc. Linn. Soc. Lond. 1849, p. 58; id., Thes. Ent. Oxon. 1874, p. 87, pl. 16, fig. 10.

Fulvous red, with the sides of the posterior part of the pronotum (as a rule) and the disk of the elytra black; head broader than long, depressed, and longitudinally channelled in front, with a conical and not strongly raised tubercle between the eyes; antennæ with a large boat-shaped club, produced at the apex into a bluntly curved point, the excavation narrow compared with that of the allied species, scarcely denticulate on its upper margin, but with strong setigerous teeth on its lower margin; pronotum divided, the parts being almost equal, the anterior part toothed at each side at the apex, and the hind margin raised and with a small emargination in the centre; elytra smooth, shining, and scarcely punctured, with fine powdery whitish setose pubescence, which is somewhat longer at the sides; legs red, not very slender, base of the femora darker; pygidium red, very closely and finely pubescent, with the row of stiff marginal setæ well pronounced.

Length 7–8 millim.

CEYLON: Rambodde; NORTH INDIA (*F. Moore*).

The species is closely allied to *P. ploiophorus* and *P. denticulatus*, from which it differs in the narrower hind part of the pronotum; the shape of the club of the antennæ and especially of the mouth of the excavation will divide it from other related species.

272. **Paussus assmuthi,** *Wasm.*

Paussus assmuthi, Wasmann, Notes Leyden Mus. xxv, 1904, pp. 47 & 58, pl. 6, fig. 4.

Red, with the disc of the elytra black and the posterior part of the pronotum pitchy, antennæ and legs rufo-piceous, front parts dull, elytra rather shiny; head and thorax coriaceous, coarsely but obsoletely sculptured, the former slightly impressed, with a narrow black line in the centre, vertex with a small round fovea; antennæ with the club boat-shaped, long, and subparallel-sided, with the apex abruptly recurved, the upper and lower margins of the excavation with teeth, in the former depressed and not marked, in the latter strong, setigerous: pronotum about as broad as the head, and almost as long as broad, deeply divided, the anterior and posterior parts being of almost equal breadth; anterior part produced in front at the sides, with the anterior margin almost straight, and the posterior margin almost semicircular, raised, somewhat impressed in the middle, and broadly emarginate or sinuate before the lateral angles; on each side in the deep dividing furrow there is a distinct fascia of yellow pilose hairs; the posterior part is gradually narrowed towards the base, slightly impressed in the middle, and deeply and broadly depressed in front; elytra finely alutaceous and sparingly and finely punctured, with short and thick setose pubescence, the lateral margin set with somewhat longer red setæ; legs slender.

Length 6 millim.

BOMBAY: Khandala (*Rev. J. Assmuth*).

Two specimens were taken by the Rev. J. Assmuth in a nest of *Pheidole ghatica*, Forel, on 22nd May, 1902.

This species is very closely allied to *P. politus*, from which, according to its author, it differs in its smaller size, the denticulation of the excavation of the antennal club, the sculpture of the head and pronotum, the prominent lateral angles of the clypeus, and the shape of the anterior portion of the pronotum (especially the emargination of the posterior margin before the lateral angles), and the thickness of the red setæ at the side margins of the elytra.

273. **Paussus bicolor**, *Raffr.*

Paussus bicolor, Raffray, Nouv. Arch. Mus. Paris (2), viii, pp. 22 & 46, pl. 19, fig. 25 (1885).

Front parts and the anterior third or quarter of the elytra black, the remainder of the elytra yellowish brown or pale brown head rugose, produced before the eyes, which are very prominent, clypeus emarginate, vertex channelled and raised into a point between the eyes which bears a hollow longitudinal fovea; antennæ rugose, with the first joint subcylindrical, widened at the apex, and the second elongate and narrow, three times as long as broad, with the sides subparallel, excavate externally along its whole length, the upper margin with four teeth and the lower with five, the basal tooth of the latter being more or less obsolete, and the rest set with small bunches of short setæ; the apex is rounded and the base is produced into a long, stout, and rather sharp tooth or process; pronotum distinctly rugose, divided, with the anterior part longer than the posterior, sinuate and bluntly but plainly produced into an angle on each side, almost as broad at the apex as the head with the eyes, the posterior part strongly excavate in front, with the sides somewhat rounded, and with a small fascicle of hairs at the apex on each side; elytra much broader than the pronotum, with the black portion at the base dull and somewhat rugose, and the remaining lighter portion scarcely punctured and gradually more shining towards the apex; pygidium brown, depressed, with the margins ciliate; fine hairs are also present at the sides of the elytra, and the surface is more or less pubescent, the pubescence being in more or less regular small patches on the elytra; legs black, long and slender.

Length 5¼ millim.

ANDAMAN ISLANDS.

This species is remarkable for its sharply and equally divided colour, and the long and narrow club of the antennæ, as well as for the length of the anterior, as compared with the posterior part of the pronotum.

274. **Paussus cardoni**, *Wasm.*

Paussus cardoni, Wasm. Notes Leyden Mus. xxv, 1904, pp. 47 & 57.

Rufo-castaneous, with the hinder part of the pronotum and the disc of the elytra black, more or less shiny, except the head which is dull; head granulosely punctured, with short white setæ, the clypeus being narrowly emarginate in front and furnished with a longitudinal black line in the centre; vertex raised, with a transverse semilunar fovea on the disc; antennæ with the club resembling, but shorter than, that of *P. nauceras*, narrowed towards the apex, with the margins of the excavation not toothed, and the lower margin set with short and fine setæ; pronotum about as long as broad, scarcely punctured, with short setæ, divided deeply in the centre; anterior portion impressed in the middle, subtruncate at the sides, with the lateral angles not strongly marked; posterior portion not narrower at its apex than the anterior, but gradually narrowed towards base; elytra plainly broader than the pronotum, very finely alutaceous, impunctate, and quite bare except for some red lateral setæ; pygidium below surrounded by an edging of broad but short tufts; legs slender, red, with the femora black.

Length 5½–6 mm.

BENGAL: Chota Nagpur, Nowatoli, and Barway.

Discovered by Cardon in nests of *Pheidole latinoda* in June 1897.

This species is allied to *P. nauceras*, from which it may be known by its somewhat larger size, less slender form, and shorter antennal club, and by not having the margins of this club toothed.

RHYSODIDÆ.

The position of this family is somewhat doubtful, as it is related to members of most of the great series, and it is certainly rather closely allied to the COLYDIIDÆ and CUCUJIDÆ, between which it is placed by Lacordaire, followed by Leconte and Horn. The latter authors believe the family to be, like the HYPOCEPHALIDÆ, BRENTHIDÆ and CUPEDIDÆ, a survival of a very ancient synthetic type. Lacordaire, although he assigns them the above position, is still of opinion that they have a real analogy with the CARABIDÆ in several points, notably the form of the prosternum, the segmentation of the abdomen, and the shape of the posterior coxæ and trochanters. The venation of the wings is Adephagid in general character (*cf.* Redtenbacher, Ann. k.-k. nat. Hof-Mus. Wien, i, 1886, pp. 211–212, pl. xviii, fig. 103), but there is no areola oblonga as in the CUPEDIDÆ; this, however, is wanting in the CICINDELIDÆ, although present in the CARABIDÆ.

The species live under bark or in the wood of more or less rotten trees; some have been found in the galleries formed by Passalid larvæ, but their life-history is practically unknown. The larva of *R. phillipensis* is said to have been once found (Revue d'Ent. xxii, 1903, p. 91), but I can find no description of it.

Head abruptly narrowed behind, with a distinct small neck, forehead with two deep sulci, temples and genæ well marked; *antennæ* inserted under the side margin of the forehead, 11-jointed, short and thick, distinctly moniliform. *Mentum* very large, covering the mouth-parts; maxillæ with two small lobes, the palpi 4-jointed.

Prosternum large, much extended in front of the anterior coxæ, coxal cavities closed behind, widely separated. *Mesosternum* very short, epimera reaching the coxæ, which are rather widely separated. *Metasternum* very long, with the epimera invisible and the episterna almost concealed, without a cross-suture before the coxæ, and emarginate between them; the posterior coxæ subtriangular and widely separated.

Abdomen with six ventral segments, the three anterior ones connate.

Legs short; anterior tibiæ terminated externally by two curved spines, and internally by a ciliated emargination with a spine; intermediate and posterior tibiæ with a strong apical spine; tarsi five-jointed.

In the first part of the new 'Catalogus Coleopterorum,' edited by Schenkling, the RHYSODIDÆ are dealt with by Dr. R. Gestro, and 109 species are enumerated. Of these 68 belong to *Rhysodes*, which is divided into four subgenera: *Dhysores* (2), *Omoglymmius* (57), *Rhysodes* s.s. (8), and *Shyrodes* (1), and 41 to *Clinidium*, the latter being placed under two subgenera, *Clinidium* s.s. (27) and *Rhysodiastes* (14). They are widely distributed both in the Old and the New Worlds, but are chiefly represented in the tropical regions of the former; only a very few species have been as yet recorded from North and South America, and two or three occur in Europe. Up to the present time fifteen species have been found in the Indian Region, but several of these have been quite recently described, and probably many more will be discovered; of these eleven belong to *Rhysodes* and three to *Clinidium*. Of those standing under *Rhysodes* no less than ten belong to the subgenus *Omoglymmius*, Gangl., and one to *Shyrodes*, Grouv.; of the other species, one is referred to *Clinidium* proper, while the other two are placed under the subgenus *Rhysodiastes*, Fairm.

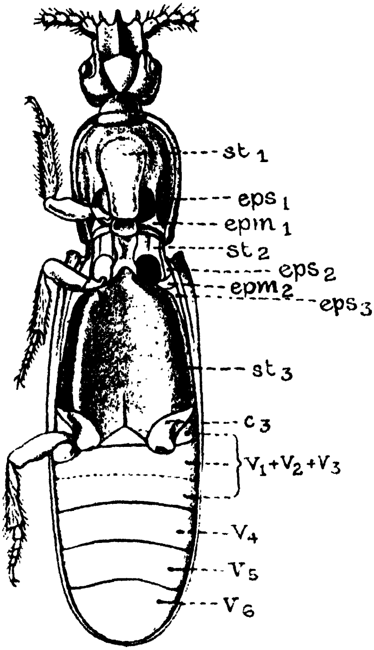

Fig. 231.—Underside of *Rhysodes germari* (female); st_1, prosternum; st_2, mesosternum; st_3, metasternum; eps_1, eps_2, eps_3, episterna of the pro-, meso-, and metathorax; epm_1, epm_2, epimera of the pro- and mesothorax; c_3, hind coxa; v_1–v_6, the ventral segments, the first three connate. (After Ganglbauer.)

Key to the Genera.

I. Eyes lateral, rounded, never elongate, usually but not always large, distinctly granulated, lower margin of their orbit not visible from above .. **Rhysodes**, Dalm., p. 503.
II. Eyes superior, elongate, or absent, scarcely granulated; if they are present the lower margin of the orbit is visible from above .... **Clinidium**, Kirby, p. 511.

Genus **RHYSODES.**

Rhysodes, Dalman, Analect. Ent. 1823, p. 93.

Type, *Cucujus sulcatus*, F.

This genus appears chiefly to differ from *Clinidium* in the shape of the eyes, which are lateral and more or less rounded; as a rule they are large, but in *R. dohertyi*, the single species belonging to the subgenus *Shyrodes*, Grouv., they are small and projecting.

For the following table I am chiefly indebted to the work of M. Grouvelle (Ann. Soc. Ent. France, lxxvii, 1908, p. 320, and Rev. d'Ent. xxii, 1903, pp. 90–104).

Key to the Species.

I. Eyes large, not projecting, central space on the head not separating the frontal lobes (subgen. *Omoglymmius*, Gangl.).
  i. Lateral furrow of the pronotum incomplete.
    1. Interstices of the elytra flat, evidently broader than the striæ; lateral furrows extending for more than three-quarters of the length of the pronotum. *arrowi*, Grouv., p. 504.
    2. Interstices of the elytra, on their disc, convex, scarcely broader than the striæ; lateral furrows scarcely attaining the middle of the pronotum .... *boysi*, Arrow, p. 505.
  ii. Lateral furrows of the pronotum complete.
    1. Frontal lobes emarginate on their inner side in a semicircle, forming on the front a deep, somewhat circular, impression, narrowly open anteriorly .. *aterrimus*, Chevr., [p. 505.
    2. Frontal lobes emarginate on their inner side, forming on the front an excavation broadly open anteriorly.
      A. External furrows of the pronotum five or six times as broad, even at their apices, as the internal furrows. *taprobanæ*, Fairm., [p. 506.
      B. External furrows of the pronotum either equal in breadth to, or much less than five or six times as broad as, the internal furrows.
        a. Interstices of the elytra carinate, the alternate ones being more distinctly raised .... *crenatus*, Grouv., [p. 507.

- *b*. Interstices of elytra not alternately raised.
  - *a**. Last joint of the antennæ acuminate at apex.
    - *a*†. Elytra with rows of punctures. *lineatus*, Grouv., p. 507.
    - *b*†. Elytra with punctured striæ.
      - *a*‡. Average size larger; head and prothorax shorter; antennæ shorter and thicker. *malabaricus*, Arrow, p. 507.
      - *b*‡. Average size smaller; head and prothorax larger; antennæ longer and less thick. *feæ*, Grouv., p. 508.
  - *b**. Last joint of antennæ blunt at apex.
    - *a*†. Form narrower; central furrow of prothorax not closed in front; head long........ *nicobarensis*, Grouv., p. 508.
    - *b*†. Form broader; central furrow of prothorax closed in front.
      - *a*‡. Form shorter, subovate; head shorter, posterior angles marked by an angular projection; colour black.. *anguliceps*, Arrow, p. 509.
      - *b*‡. Form larger, oblong; head longer, posterior angles not marked by an angular projection; colour dark castaneous................ *longiceps*, Grouv., p. 510.
- II. Eyes small, projecting (subgen. *Shyrodes*, Grouv.)............................ *dohertyi*, Grouv., p. 510.

275. Rhysodes arrowi, *Grouv.*

Rhysodes arrowi, Grouvelle, Ann. Soc. Ent. France, lxxvii, 1908, p. 368.

Elongate-oval, shining black, glabrous; head slightly transverse, with the posterior lobes not elongate, rounded and approximate at base, emarginate in a semicircle on their inner side, and then continued in straight diverging lines to the lateral margins of the thorax, the space between them being more or less diamond-shaped; antennæ with joints 2–10 subtransverse, 3 subcordiform, last joint strongly acuminate; pronotum elongate, oblong, broader than the head, with three longitudinal furrows, the central one entire, and the lateral ones narrowed or abbreviated in front, but deeply impressed before the base, and joined to the base by a broad oblique furrow; elytra punctate-striate, with the interstices flat, evidently broader than the striæ, the second and fifth joined at apex and forming an apical callosity; shoulders toothed; legs short.

Length 8½ millim.

SIKKIM.

Type in M. Grouvelle's collection.

276. Rhysodes boysi, *Arr.*

Rhysodes boysi, Arrow, Ann. Mag. Nat. Hist. (7) vii, 1901, p. 87.

Black, shining, depressed; head triangular, without carinæ or lateral channels, but with a diamond-shaped flat space in front, behind which there is a deep circular foramen or large fovea not reaching the base; antennæ moderate; prothorax long, without raised costæ, but with an entire central furrow, and on each side of this an almost pear-shaped depression, which is very broad at the base, and very narrow just about the middle, where it ceases; elytra with deeply punctured striæ, the fourth interstice strongly raised behind; anterior femora not toothed in the female.

Length 7 millim.

KASHMIR (?)

Type in the British Museum.

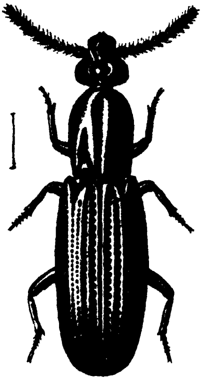

Fig. 232.—*Rhysodes boysi.*

The species was described from two females, probably from the Himalayan Region; one of these is in the British Museum, and the other in the Oxford Museum. The male is not known.

277. Rhysodes aterrimus, *Chevr.*

Rhysodes aterrimus, Chevrolat, Ann. Soc. Ent. France (5) iii, 1873, p. 209.

Rhysodes armatus, Arrow, Ann. Mag. Nat. Hist. (7) vii, 1901, p. 85.

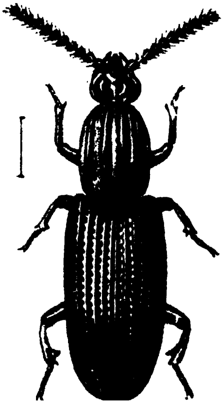

Fig. 233.
Rhysodes aterrimus.

Pitchy black, rather dull, cylindrical; head produced behind the eyes, posterior lobes twice approximating on the vertex, anterior elevated space short, constricted in the middle; at the back of the head is a small punctiform fovea which is distant from the central raised space; prothorax long, with the sides almost straight, the disc trisulcate, with the external sulci broad and with four almost parallel carinæ, the two central ones nearly or actually meeting in front and behind; elytra with broad punctured striæ; smooth parts of the head and prothorax punctured, underside very coarsely punctured; anterior tibiæ bidentate at apex, with a third tooth in the centre.—Male with the anterior tibiæ furnished with a fourth tooth a little behind the middle, the anterior femora dentate in the middle, and the intermediate and posterior tibiæ furnished with a bispinose plate at the apex.

Length 7½–9 millim.

ANDAMAN and NICOBAR ISLANDS; MALACCA: Penang.

Type of *R. armatus* in the British Museum.

The male characters and the sculpture of the head will serve to distinguish this insect from all the other Indian species. The two most nearly allied species are *R. strabus*, Newm. (from the Malay Archipelago) and *R. crassiusculus*, Lewis (from Japan), both of which resemble *R. aterrimus* in the sculpture of the head and the armature of the male.

278. **Rhysodes taprobanæ**, *Fairm.*

Rhysodes taprobanæ, Fairmaire, Ann. Soc. Ent France (5) iii, 1873, p. 389.
? *Rhysodes punctatostriatus*, Mots., Bull. Moscou, ii, 1866, p. 400.

Elongate, shining, pitchy black; head narrowed before the eyes, with two deep furrows which meet in a curve behind; antennæ with the joints transverse, the last ones being pilose; prothorax somewhat ovate, truncate at base, with three furrows, the lateral ones being much the broader, marginal furrows deep and narrow, the two central carinæ narrower at the base and slightly separated in front, where they enclose a narrow space, but this is variable: elytra with rows of strong punctures, but not strongly striate except for the sutural stria, which is deep with scarcely visible punctures, fourth interstice strongly raised at apex, the raised portion curving round to the suture and giving the impression of a large depressed space before the apex, which is more distinct than in some of the allied species; ventral segments with single series of strong punctures; anterior tibiæ with two sharp teeth before apex.

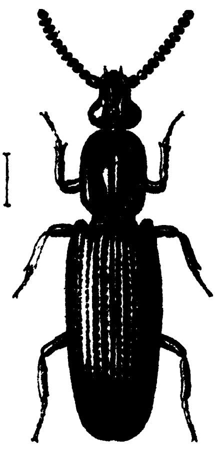

Fig. 234.
Rhysodes taprobanæ.

Length 5 millim.

CEYLON.

It seems most probable that the above synonymy is correct, *R. punctatostriatus* having been described by Motschulsky from Ceylon. Grouvelle (Rev. d'Ent. xxii, 1903, p. 97) introduces a *R. punctatostriatus* from Sumatra into his table of species, but this is really *R. punctatolineatus*, described by him on page 116, and he has simply made a mistake in the names; it has nothing to do with Motschulsky's species. Grouvelle himself has corrected the mistake subsequently (Ann. Soc. Ent. Fr. 1908, p. 317). *R. punctatostriatus*, Mots., was omitted from the Munich Catalogue, but is wrongly, we think, restored in the new Catalogue by Gestro.

279. Rhysodes crenatus, *Grouv.*

Rhysodes crenatus, Grouvelle, Rev. d'Ent. xxii, 1903, p. 119.

Elongate-oblong, shining black; head a little longer than broad, produced on each side beneath, with the posterior lobes elongate and smooth, separated by a deep furrow and emarginate on their inner side and towards the base, anterior furrows enclosing a smooth, more or less lozenge-shaped space; antennæ with joints 2–10 transverse, subconical; prothorax a little longer than broad, subparallel-sided, with the angles rounded and with four convex, smooth, longitudinal ridges on each, the interior pair joining at the apex; the furrows between these are foveolate at the base; elytra with deep crenulately punctured striæ, interstices carinate, the alternate ones being more distinctly raised, the shoulders toothed.

BHUTAN.

Type, ♀, in M. René Oberthür's collection.

280. Rhysodes lineatus, *Grouv.*

Rhysodes lineatus, Grouvelle, Ann. Soc. Ent. France, 1908, p. 319.

Elongate-oblong, shining pitchy black, with the antennæ and part of the legs reddish; head about as long as broad, with the posterior lobes somewhat elongated, rounded at base, angled and approximate on their inner side and then divergent, intermediate space in the shape of an inverted lance-head; prothorax moderately long, ovate and depressed, with four longitudinal depressed and equal-sized ridges on each, the intermediate furrows closed at their extremities, the ventral one narrow; elytra oblong, broader than the prothorax, punctured in lines, without striation except near the suture and towards the base, the intervals much broader than the rows of punctures, the apical depression with yellow setæ.

Length 5½ millim.

MADRAS: Shembaganur (*R. P. Dubreuil*).

Type in M. Grouvelle's collection.

The sculpture of the elytra and the depressed ridges of the prothorax will help to distinguish this species.

281. Rhysodes malabaricus, *Arr.*

Rhysodes malabaricus, Arrow, Ann. Mag. Nat. Hist. (7) vii, 1901, p. 86.

Shining black; head as long as broad, with the lobes prominent, a little flattened behind, with the vertex furnished with an almost circular foramen, the central elevated portion being narrow and reaching this ; antennæ short and thick ; prothorax subovate, with four ridges on each side of almost equal breadth ; elytra with punctured striæ, the punctures being confluent, shoulders with a minute tooth, apical semicircular carina distinct ; abdomen coarsely punctured ; anterior tibiæ bidentate on both sides.

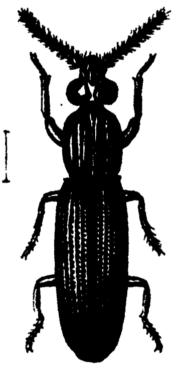
Fig. 235.—*Rhysodes malabaricus.*

Male with the femora acutely dentate in the middle, and the posterior tibiæ strongly curved at the apex.

Length 6½ millim.

MADRAS : Malabar.

Type in the British Museum.

The short head, with its peculiar foramen, and the broad and very prominent posterior lobes, which appear rather flattened externally, owing to the projection of the eyes in front, are useful characters for the determination of this species.

282. **Rhysodes feæ,** *Grouv.*

Rhysodes feæ, Grouvelle, Ann. Mus. Genova, (2) xiv, 1894, p. 761.

Shining pitchy black ; head longer than broad, subtriangular, with the posterior angles slightly rounded and the posterior lobes produced behind, the disc with two longitudinal furrows united at base and enclosing an elongate depressed space, which is foveolate at its apex ; prothorax a little longer than broad, furnished on its disc with four subequal ridges and five furrows ; elytra with seven crenulately punctured striæ and with short raised hairs, which are scanty and fugitive on the disc but are somewhat more numerous at the apex ; last joint of the antennæ acuminate at the apex.

Length 6 millim.

BURMA : Karen-ni (*L. Fea*).

Type in the Genoa Museum.

283. **Rhysodes nicobarensis,** *Grouv.*

Rhysodes nicobarensis, Grouvelle, Ann. Mus. Genova, (2) xiv, 1894, p. 762.

This species appears to bear relations both to *R. feæ* and *R. taprobanæ.* From the former it differs by the more irregular breadth of the prothoracic ridges, the lateral ones being reduced to carinæ ; the lobes of the vertex are not prominent behind and the antennæ are proportionally thicker. It is a larger species than *R. taprobanæ,* with the intervals between the thoracic ridges much broader and the ridges themselves differently shaped ; the elytra moreover are striate and not punctured in rows. None of the prothoracic ridges quite reach the apex ; the last joint of the antennæ is blunt at the apex.

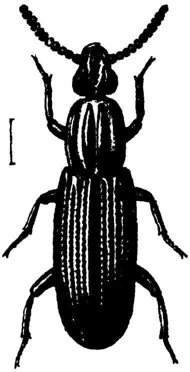

Fig. 236.—*Rhysodes nicobarensis.*

Length 6 millim.

Nicobar Islands.

Type in the British Museum.

284. **Rhysodes anguliceps,** *Arr.*

Rhysodes anguliceps, Arrow, Ann. Mag. Nat. Hist. (7) vii, 1901, p. 89.

Shining black, less elongate than usual; head comparatively very small, triangular, much produced before the eyes, posterior lobes with a circular outline interrupted only at the sides of the head, where they are rather produced backwards; on each side above the eyes is a curved channel, the smooth space in front of the lobes being large and broad; antennæ comparatively short, with the apex of the last joint blunt; prothorax large, with the sides rounded and contracted in front, trisulcate, both the furrows and the ridges being large and deep, all the sulci extending from base to apex or very nearly so; elytra with deep and subcrenulately punctured striæ, the shoulders produced but not toothed; tibiæ bidentate on each side.

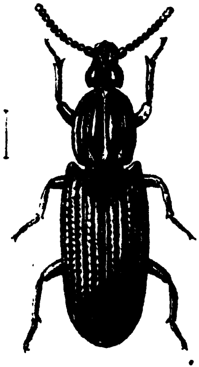

Fig. 237.
Rhysodes anguliceps.

Male with the anterior femora furnished with minute teeth ; posterior tibiæ produced into a brush-like plate at apex.

Length 6½ millim.

Madras : Malabar.

Type in the British Museum.

As Mr. Arrow points out, the species appears to differ from all the others in the structure of the head, which has the posterior lobes circular in outline instead of kidney-shaped, as in the other species. There are specimens of this species in the British Museum and in the Oxford Museum.

285. **Rhysodes longiceps**, *Grouv.*

Rhysodes longiceps, Grouvelle, Bull. Soc. Ent. France, 1910, p. 324.

Elongate, oblong, of a dark shining castaneous colour; head long, longer than broad, subparallel-sided, with the posterior lobes elongate and convex, subacuminate at the base, angled and approximating on their inner side, joined in front to the lateral margins, with the intermediate space in the shape of a broad lance-head, pointed behind, produced and impressed in front; antennæ thickened in the middle; prothorax roughly ovate, depressed, about one-and-a-third times as long as broad, with four longitudinal ridges on each, the internal pair depressed, the external raised; the central furrow is narrowed in the middle and closed at each extremity, those on each side of it being widened at the base; elytra oblong, broader than the prothorax, with deep punctured striæ, the interstices being as broad as the punctures and very convex.

Length 7 millim.

BURMA.

Type in M. Grouvelle's collection.

Described from a single specimen.

286. **Rhysodes dohertyi**, *Grouv.*

Rhysodes (*Shyrodes*) *dohertyi*, Grouvelle, Rev. d'Ent. xxii. 1903, p. 126.

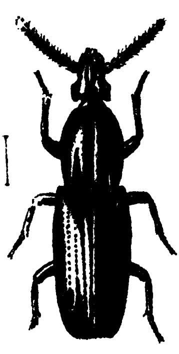

Fig. 238. *Rhysodes dohertyi.*

Elongate-oblong, of a shining chestnut colour; head triangular, elongate, much produced before the eyes, evenly rounded in front; eyes small and prominent, frontal lobes elongate, separated by a deep furrow, with the intermediate space elongate, diamond-shaped, impressed at apex; prothorax long, narrowed in front, trisulcate, with the central furrow almost entire and the external ones short, almost like foveæ, broad near the base; elytra oblong, depressed at base, with rows of punctures, the striation being scarcely marked and being more or less effaced at apex.

Male with the posterior tibiæ terminated on their inner side with a projecting, bidentate lobe.

BURMA: Ruby Mines (*Doherty*).

Type in the British Museum; *cotype* in M. Grouvelle's collection.

Genus **CLINIDIUM.**

Clinidium, Kirby, Zool. Journ. v, 1835, p. 6.

Type, *C. guildingi,* Kirby.

This genus has the eyes elongate and much more finely granulated than in *Rhysodes,* Dalm. There seems however to be no particularly strong reason for its separation, and we might, with quite as good reason, raise the subgenus *Shyrodes,* with its small prominent eyes, to generic rank.

Key to the Species.

I. Furrows of the prothorax on each side of the central furrow not reaching the apex (subgen. *Clinidium,* s. s.)	*apertum,* Reitt., p. 511.
II. Furrows of the prothorax on each side of the central furrow entire (subgen. *Rhysodiastes,* Fairm.).	
1. Central furrow of prothorax excavate at a third from the base..........	*fairmairei,* Grouv., p. 511.
2. Central furrow not excavate at a third from base......................	*waterhousei,* Grouv., p. 512.

287. **Clinidium apertum,** *Reitt.*

Clinidium apertum, Reitter, Verh. Nat. Ver. Brünn, xviii, 1880, p. 29.

Dark pitchy, shining, with the elytra reddish; head almost as long as broad, with the posterior lobes distinct, and with two deep furrows enclosing a diamond-shaped space in front; antennæ moniliform, with the joints scarcely transverse; prothorax long, with the sides somewhat rounded and with seven furrows or channelled striæ, the central dorsal one deep, reaching both base and apex, the four lateral narrow and approximate to one another and to the margin, also reaching base and apex; in the space between these there are at the base two short broad furrows, which are widened behind and cease behind the middle; elytra usually reddish, with deep sulcate striæ which are scarcely punctured and the interstices more or less raised, the humeral angles large and produced into a projecting lobe.

Length 7 millim.

HIMALAYAS.

Type in Reitter's collection.

288. **Clinidium fairmairei,** *Grouv.*

Clinidium (*Rhysodiastes*) *fairmairei,* Grouvelle, Ann. Mus. Genova, (2) xiv, 1895, p. 762.

Shining black; head elongate, with four longitudinal furrows, the external ones being straight and the internal ones curved and enclosing an elongate space which is foveolate in front and at the base united in an elongate triangular depression; prothorax elongate-oval, with two ridges on each side and with the separating furrows complete, the central furrow being excavate at a third from the base; elytra with three raised ridges on each side and with well-marked deep spaces between, the internal ridge abbreviated at base and apex, the next humeral and almost entire, and the third lateral and forming at apex a thick raised prominence; the shoulders sharp but not very projecting, the punctuation of the spaces between the elytral carinæ not close.

Length 6½ millim.

Burma: Karen-ni (*L. Fea*).

Type in the Genoa Museum.

289. **Clinidium waterhousei**, *Grouv.*

Clinidium (*Rhysodiastes*) *waterhousei*, Grouvelle, Bull. Soc. Ent. France, 1910, p. 326.

Elongate, rather narrow, subparallel-sided, black, elytra with a reddish reflection in a strong light (this may be due to slight immaturity); antennæ moniliform, very slightly narrowed towards the apex, with joints 2–10 transverse, about equally broad, the eleventh about as long as broad, acuminate at its apex; head subtriangular, with the posterior lobes large, prominent, and smooth, separated by a narrow channel which is bifurcate in front, the two furrows embracing the basal portion of a rather large lance-head-shaped smooth space; prothorax long, oblong, with the central and side furrows well marked and entire and with two strong basal impressions between the central and side furrows, central furrow a little impressed, but not excavate, at the posterior third; elytra very deeply impressed at the scutellary region, strongly sulcate, with the furrows scarcely punctured, and with the interstices raised and forming three not very well-marked carinæ on each, the first ceasing before the apex, the second reflexed and raised near the scutellum, and the third (humeral) reaching the apical raised space; on each side of the ventral segments there is a strong transverse impression.

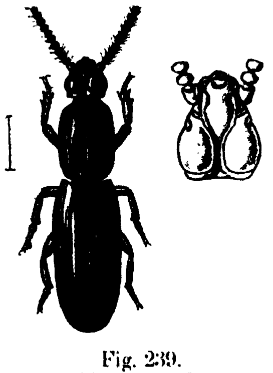

Fig. 239.
Clinidium waterhousei.

Length 6 millim.

Burma: Ruby Mines (*Doherty*).

Type, ♀, in the British Museum.

CUPEDIDÆ.

We have already (p. 68) discussed the much disputed question of the position of this family. Its chief characters are as follows:—

Head small, with strong tubercles, suddenly constricted behind into a very short neck; eyes lateral, rounded, finely granulate, rather projecting. *Mentum* small, ligula very small, bilobed; maxillæ with two lobes, the outer one corneous and hooked, the inner small, coriaceous; maxillary palpi 4-jointed; labrum transverse, very short, truncate and ciliate in front. *Antennæ* inserted on the anterior portion of the front, rather stout, tapering or slightly serrate. *Thorax* variable; pronotum separated by sutures from the pleuræ of thorax; anterior coxal cavities small, transverse, open behind. *Elytra* elongate, depressed, more or less parallel-sided, with rows of large square punctures, giving a lattice-like appearance to the sculpture; epipleuræ narrow, but extending to the apex. *Legs* rather short, slender and contractile; anterior coxæ small, not prominent, slightly separated; middle coxæ contiguous, posterior coxæ transverse; tarsi 5-jointed, spongy beneath. *Venter* with at most five segments, the first connate with the second. Body as a rule covered with small greyish scales.

Genus **CUPES**.

Cupes, Fabricius, Syst. El. ii, p. 66.

Type, *Cupes capitatus*, F.

The characters of the genus are those of the family; one species only is known from the Indian region.

290. **Cupes clathratus**, *Sols.*

Cupes clathratus, Solsky, Hor. Soc. Ent. Ross. vii, 1870, p. 370.
Cupes ocularis, Pascoe, Ann. Mag. Nat. Hist. (4) x, 1872, p. 319.

Dull brown or greyish brown. Head transverse, produced squarely before the eyes, bituberculate at base, with the vertex between the raised portions distinctly sulcate longitudinally; eyes very prominent, the temples behind these well-marked; antennæ long and stout, tapering towards apex (reaching to between one-half and two-thirds of the elytra), second joint very short, the rest very slightly and gradually increasing in length, subequal; head and prothorax with small light brown scales, which are also present, if not rubbed off, on the elytra; pronotum transverse, very uneven, much depressed on both sides of the central line, which is raised, much wider abruptly just behind apex, and produced at the sides in front in a sharp angle; scutellum well marked; elytra long, parallel-sided, rounded at the apex, with the shoulders well marked, and with rows of large square punctures, the interstices being more or less carinate, the 4th and 6th strongly so; legs short and not stout, the anterior tibiæ slightly curved; underside squamose.

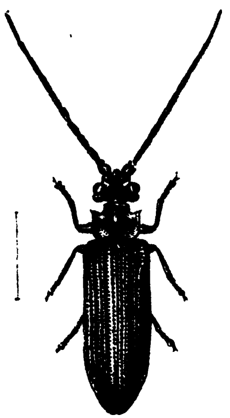

Fig. 240.
Cupes clathratus.

Length 12–15 mm.

BURMA: Ruby Mines (*Doherty*); EASTERN SIBERIA (*Solsky*); JAPAN (*Lewis*).

After careful examination I can find no difference between the Burmese specimens and those of Mr. Lewis from Japan; the sculpture of the elytra is slightly different, but this varies in specimens belonging to the same species.

Of the two specimens taken by Mr. Doherty, the one which I believe to be the male is smaller, with a small clear space on the apical segment of the venter, and with the temples projecting laterally only as far as the level of the eyes. In the other, which is probably the female, the temples plainly project laterally beyond the eyes.

Pascoe's type of *C. ocularis* in the British Museum Collection measures 6 lines; in his description he gives its length as 5 lines.

Notes on the Life-History of Tricondyla *and* Collyris.

On page 275 I have said that "I cannot find that anything is known of the life-history of *Tricondyla* and *Derocrania*. Just as this book is going to press the last volume of the Zoological Record has been published, and I find that I have missed a paper by Dr. van Leeuwen in the Tijdschrift voor Entomologie, June 1910, pp. 18–40, plates 2 & 3, entitled "Ueber die Lebensweise und die Entwicklung einiger holzbohrenden Cicindeliden-Larven," and containing the life-histories of *Collyris bonelli* and *tuberculata* and of *Tricondyla cyanea*. We have no space to enter into the details of this paper, further than to state the remarkable similarity of the *Tricondyla* larva to that of *Collyris*: the fifth abdominal segment is humped in the same way and has the three small hooks on each side, and the insect has the same habit of making burrows in the stems of the coffee-shrub and seizing its prey at the entrance of these. It is, of course, larger, being 20 millim. in length, but otherwise there is very little difference.

Mr. H. E. Andrewes has kindly sent me a letter, received from Mr. H. Leslie Andrewes, which throws further interesting light on the life-history of *Collyris*; he writes as follows:—"I was pruning some 4-year old tea, and, when cutting through a branch about two years old, I went through the fore portion of the abdomen of a *Collyris* sp.? (imago), and the front part wriggled out of the hole and dropped on the ground. The branch was about five-eighths of an inch thick. There was an external hole (presumably for getting rid of excrement) at an angle of about 120° with the burrow in which the beetle was. It was stopped up with blackish excrement. There was a very little powdered stuff in one end of the hole which had evidently been a pupal envelope of some kind, presumably that of the *Collyris*." Mr. Andrewes does not think that the beetle could possibly have got into the branch for predatory purposes, and, as far as he could judge, it had lived in the boring from the egg-stage.

The occurrence of *Collyris* in both tea and coffee shrubs is very interesting, and may ultimately prove to be of economic importance —whether for good or for evil seems a matter of doubt; on the one hand the borings, if numerous, must, apparently, injure the trees, while, on the other hand, large numbers of injurious insects must be destroyed by the voracious larvæ.

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